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THIRTY-FOURTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

Massachusetts Board of Agriculture,

WITH

RETURNS OF THE FINANCES OF THE
AGRICULTURAL SOCIETIES,

FOR

1886.

BOSTON:
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1887.

STATE BOARD OF AGRICULTURE, 1887.

Members ex officiis.

His Excellency OLIVER AMES.
His Honor J. Q. A. BRACKETT.
Hon. HENRY B. PEIRCE, *Secretary of the Commonwealth.*
CHARLES A. GOESSMANN, *State Agricultural Chemist.*
H. H. GOODELL, *President Massachusetts Agricultural College.*

Appointed by the Governor and Council.

	Term expires.
JAMES S. GRINNELL of Greenfield,	1890
JAMES R. NICHOLS of Haverhill,	1888
JAMES W. STOCKWELL of Sutton,	1889

Chosen by the County Societies.

Amesbury and Salisbury,	J. H. HILL of Amesbury,	1888
Bay State,	EDWARD BURNETT of Southborough,	1890
Barnstable,	NATHAN EDSON of Barnstable,	1889
Berkshire,	HARVEY M. OWEN of Pittsfield,	1888
Blackstone Valley,	VELOROUS TAFT of West Upton,	1888
Bristol,	AVERY P. SLADE of Somerset,	1890
Deerfield Valley,	F. G. HOWES of Ashfield,	1890
Essex,	BENJAMIN P. WARE of Beach Bluff,	1890
Franklin,	ZERI SMITH of Deerfield,	1889
Hampden,	ETHAN BROOKS of West Springfield,	1888
Hampden East,	WILLIAM R. SESSIONS of Hampden,	1888
Hampshire,	WM. W. SMITH of Amherst,	1889
Hampshire, Franklin & Hampden,	JONATHAN D. PORTER of Hatfield,	1888
Highland,	W. H. SNOW of Becket,	1890
Hingham,	EDMUND HERSEY of Hingham,	1888
Hoosac Valley,	DANIEL UPTON of Adams,	1888
Housatonic,	MERRITT I. WHEELER of Great Barrington,	1888
Hillside,	S. W. CLARK of Plainfield,	1890
Marshfield,	DANIEL E. DAMON of Plymouth,	1888
Martha's Vineyard,	HENRY L. WHITING of West Tisbury,	1889
Massachusetts,	E. F. BOWDITCH of Framingham,	1888
Massachusetts Horticultural,	E. W. WOOD of Newton,	1888
Middlesex,	JOHN B. MOORE of Concord,	1888
Middlesex North,	A. C. VARNUM of Lowell,	1889
Middlesex South,	S. B. BIRD of Framingham,	1890
Nantucket,	R. E. BURGESS of Nantucket,	1888
Plymouth,	ELDRIDGE CUSHMAN of Lakeville,	1890
Union,	S. A. BARTHOLOMEW of North Blandford,	1889
Worcester,	C. L. HARTSHORN of Worcester,	1890
Worcester North,	GEO. CRUICKSHANK of Fitchburg,	1890
Worcester North-West,	J. P. LYNDE of Athol,	1889
Worcester South,	BAINBRIDGE DOUTY of Charlton,	1889
Worcester West,	J. HENRY GODDARD of Barre,	1890

JOHN E. RUSSELL,
Secretary.

THE

THIRTY-FOURTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

BOARD OF AGRICULTURE.

To the Senate and House of Representatives of the Commonwealth of Massachusetts.

The farming interests of the Commonwealth are in about the same condition as represented in the last annual report.

Another year's work has been done. Farmers have supported their families and made a few permanent improvements; if there is no marked prosperity, neither is there agricultural distress.

In common with all other civilized States, Massachusetts attempts to encourage agriculture by rewards and immunities. Early in our history, societies were established under the charter of the General Court, and bounties were paid to them upon condition that they should make return of their transactions to the Secretary of the Commonwealth. In 1851, under the lead of the late Hon. Marshall P. Wilder, a convention of delegates from the county societies was held in Boston. It included the leading agriculturists of the State, and at the head of the list was the venerable ex-Governor Lincoln of Worcester. The purpose of this gathering was "the promotion of the cause of agricultural education." This meeting had an immediate influence. The next year, by an act of the Legislature, the present State Board of Agriculture was created, to consist of the Governor, the Lieutenant-Governor, the Secretary of State, three members at large appointed by the Governor, and a delegate from each chartered society receiving the bounty of the State. To this body have since been added the State chemist and the president of the Agricultural College. The present year there are thirty-three delegates from as many chartered societies. The Board elects its secretary.

The original purpose of the Board was to regulate and systematize the distribution of the State bounty through the county societies, to supervise their actions, and to report upon them to the Legislature. The scope of the Board has been greatly enlarged by subsequent acts of the Legislature; by the establishment of the State Agricultural College, of which it is a board of overseers; by the act of the Legislature known as the "Fertilizer Law;" by the formation of great numbers of farmers' clubs and town societies, reporting to the Secretary of the Board; and, latterly, by the great increase of the grange system, through which its reports are now largely distributed.

In 1878 the Board ordered that each society receiving the State bounty should hold at least three "farmers' institutes" within its limits in the course of a year, promising at the same time to furnish all the aid in its power to render such meetings instructive and attractive to the public.

This proved to be a movement of the utmost importance to our agriculture; hundreds of meetings have been held in all parts of the State, awakening an unusual spirit of inquiry and leading to valuable experiments and greatly increased knowledge. The institute system greatly added to the labors of the members of the Board and to the work and responsibility of the Secretary.

Two years ago the Board rescinded the order compelling the county societies to hold the institutes, but at the same time recommended the continuance of them without the direct assistance of the members of the Board or the Secretary; at the annual meeting in February last the order was reaffirmed and is now in force.

The annual fairs of the year past were largely attended and very successful, except when interrupted by stormy weather. The new Bay State Society held a late meeting in Boston, which was one of the most successful and instructive exhibitions ever held in the United States.

The annual country meeting of the Board was held at Barre; it continued through three days; the attendance was large and enthusiastic. The lectures and subsequent discussions are printed in this volume.

I should be glad to say that we were enjoying our usual immunity from diseases of cattle; but, in fact, owing to the lax laws or lack of law in other States, we are invaded by pleuro-pneumonia from several points.

We have a cattle commission clothed with ample powers, a disposition to enforce the law and the experience of the past to guide our steps, so that there is no fear that contagious cattle diseases will make a permanent lodgment in our herds. The dairy is the leading interest of our farmers. Our cities are supplied with milk from our farms, and though we are not subject to competition from abroad, the profits of the business are small, owing to the fact that the farmers are under the control of the contractors and other middlemen, who make great profits out of a business that should, through co-operation, be controlled by the milk-producers. As we purchase the greater part of our grain from the West, we have a deep interest in the effect of the Inter-State Commerce Law, especially upon the business of milk-producing. At the end of another year, through the investigation of the granges and the discussions at our meetings, the effect of this law upon our farming will be well understood.

JOHN E. RUSSELL,
Secretary of the State Board of Agriculture.

BOSTON, February, 1887.

SPECIAL MEETING

OF THE

BOARD OF AGRICULTURE

AT BARRE.

SPECIAL MEETING

OF THE

BOARD OF AGRICULTURE.

A special meeting of the Board was held at the Town Hall in Barre on the evening of November 29, at the request of the Cattle Commissioners. The meeting was called to order by Secretary RUSSELL, who was, on motion, elected Chairman.

The CHAIRMAN. Gentlemen of the Board of Agriculture, —I have notified you of a business meeting of the Board to be held prior to the annual country meeting, and the business will be to hear a report or statement from the Cattle Commissioners of this Commonwealth in regard to the interest that they represent. They wish the assistance or the advice of this Board in matters that they will more satisfactorily explain to you than I can do, and in furtherance of the business I will call upon the Chairman of that Commission to state to you the objects of this meeting.

Mr. A. W. CHEEVER. Mr. President and Gentlemen,— The Governor of the State appointed two delegates to attend the Cattle Growers' Convention in Chicago, held on the 16th and 17th of this month. Dr. Peters, who is in the employ of the Massachusetts Society for the Promotion of Agriculture, and myself were the two delegates. Dr. Loring was also present as a delegate from the New England Society, and Major Alvord from the Agricultural College.

Last year, when I went on the same errand, the Governor made a special request that the delegates would attend the veterinary meetings and learn what might be learned regarding the condition of contagious diseases in the country. This year no such special request was made; but being connected with the Cattle Commission, and feeling that it was a more important matter this year than last, we took what means we could to learn the condition of pleuro-pneumonia as it exists at the West, and Dr. Peters spent several days specially investigating the matter. He has prepared a report; but I will not take your time here in reading it, unless it is desired. I would state instead that there is no doubt now in the minds of the delegates that contagious pleuro-pneumonia, the same disease that Massachusetts had experience with some twenty or more years ago, exists in the vicinity of Chicago. Four large distillery stables in the suburbs, where from 2,500 to 3,000 cattle are kept, have the disease badly, and up to within a short time the stock-yards' interest, which means the cattle-trading interest of Chicago,—the name "stock yards" corresponding with Brighton market here in Massachusetts,—up to within a very short time, I say, the people there interested in the business have denied the existence of any contagious disease, have scouted the idea; and during the past year they have blocked congressional action in the direction of getting a stronger law for the suppression of the disease; but one of the leading men in the Cattle Growers' meeting read a paper in which he acknowledged that the time had gone by for denying the existence of the disease. He did not say, "We no longer dispute it," but he said, "We do not propose to place our judgment against the combined veterinary skill of the country," and then went on to recommend what should be done to stamp it out. Among other things he recommended the abolishment of the Bureau of Animal Industry, and the institution of a Cattle Commission instead, like the Massachusetts Cattle Commission. His paper was not received with the cordiality that it would have been if he had left that part out relating to the Bureau of Animal Industry. That Bureau has the sympathy of the cattle growers of the country, unquestionably; but they want a stronger law, and they want the United States to do what the State alone cannot do.

Several resolutions were introduced there and passed, after a good deal of discussion, and I have drafted three, embodying such parts of those resolutions as I felt like presenting before this meeting for discussion; and to open the subject fairly and place it before the meeting, I will read the following resolutions: —

Resolved, That the Secretary of the Board of Agriculture be and hereby is instructed to communicate with the President of the United States and request him to call the special attention of Congress to the outbreaks of contagious lung plague among cattle in the vicinity of Chicago, and to ask of Congress such legislation at the earliest practicable moment as will tend to the eradication of this disease from the entire country.

Resolved, That the Secretary be further instructed to address letters to the several members of Congress from this Commonwealth urging upon them the importance of giving this subject their early and earnest attention.

Resolved, That we recognize with gratification the value of the work of the Bureau of Animal Industry in so far as its limited means hitherto have permitted it to aid in the work of investigating and stamping out contagious diseases among the domestic animals of our country.

There are other matters that might be brought in here for a more or less informal talk in regard to what the Cattle Commission ought to do, and what the State ought to do, in the emergency. Whether there is an emergency really at the present time that calls for heroic action, is the question. I think something like thirteen States have quarantined against the State of Illinois or the district around Chicago. The Western people are determined that the disease shall not come into their Territories if it is possible to keep it out. The State of Michigan had not yet adopted any restrictive measures, but was waiting to learn what was done at this meeting; and the Commissioners, who were present, expected that very likely when they got home again, they would quarantine Michigan and refuse the passage of cattle from Chicago into the State. They were very earnest generally at the West, where they feel the importance of keeping this disease from the ranch districts.

The Cattle Commission of Massachusetts have done what, in their opinion, seemed called for. Last spring a request was sent to the Commission asking if there were any restrictions against bringing Jersey cattle from New York or elsewhere to Boston to sell at auction; and the Commission felt that, whether there were any or not, perhaps it would be well to have some; and, after consultation, it was agreed to require an affidavit or certificate from a veterinarian, certifying that each and every animal brought in here was healthy; and, furthermore, an affidavit from the owner that said animal had not been in any infected district, or in any way exposed to any contagious disease, during one year preceding. Since this excitement at Chicago the Commission have tried to learn what they ought to do under the circumstances, but have been waiting, and have not done anything yet. To undertake to quarantine the State against the shipment of beef cattle or store cattle from Chicago over the Grand Trunk, the Vermont Central and the two or three other trunk lines, to stop them when they come to the borders of the State, subject them to a rigid inspection, put them in quarantine for three months, and treat all cattle that are brought here for shipment to Europe in the same way, is a considerable undertaking, and the Commission have not felt like taking that step until it seemed absolutely necessary. The general feeling of the meeting at Chicago, and of Dr. Salmon, the head of the Bureau, was that quarantines are very dangerous things to undertake, should not be adopted except as the last resort, are hard to maintain and very injurious to the business of the country.

Mr. Ware. I should like to move the adoption of the resolutions.

Mr. Bowditch. Before a vote is taken I would like to ask if the paper that the gentleman said was read by one of the stock-yard men suggested any way of stamping out the disease?

Mr. Cheever. Mr. Washburn, in his lengthy paper, laid out a good deal of work which he thought ought to be done, and it was not very different from the work that is being done by the Bureau of Animal Industry at Washington. It seemed to the meeting that there was a bitterness towards the veterinarians on the part of the stock-yard people whom Mr. Washburn represented, and that, unless they could have their own way of doing things, they did not intend to help much. He wanted the Bureau of Animal Industry abolished, and a Commission appointed by the President which should continue as long as there was any necessity for it and then die. He did not want any Bureau of Animal Industry, which is doing a great deal of solid scientific work in relation to the investigation of disease, and has published two valuable volumes on that subject. Those he ignored entirely as of no use. His method otherwise was not unlike the common method, which is to have the general government appropriate whatever sum may be necessary to stamp out the disease from the country. That is what the friends of the present Commission have asked for, and have not received, for the reason that the stock-yards people have fought them.

Mr. Slade. Do we understand that what is meant by "stamping out" is killing the cattle and paying for them?

Mr. Cheever. Restricting the disease to the localities where it exists, slaughtering the cattle and destroying all that have the disease or have been exposed to it.

Mr. Bowditch. And paying for those same cattle?

Mr. Cheever. They are to be paid for, as a matter of necessity, but the exact proportion to be paid is a matter to be left for discussion and action by the Congress which enacts the law. It is understood that if liberal prices are paid it is offering a premium upon sick cattle; if too small prices are paid it encourages hiding cattle away, and the point will be to get at the right medium. Private property cannot be taken out of the hands of private owners without compensation, according to the principles of law. At the present time the Bureau of Animal Industry has no power to pay for animals killed that are not already sick, and the law is weak in that regard. They have not the power which Massachusetts took into her own hands at the time the disease was here. Dr. Salmon has the confidence of all the veterinarians in the country, I think, and of the cattle men generally. He is at the head of the Bureau of Animal Industry. He worked very hard last winter at the meeting to impress it upon people that that Bureau must have authority put into its hands to stamp out the disease, and funds large enough to do it. He asked for a much larger sum than was granted. There were men at the meeting who thought that a great many million dollars would be required, and there were others who believed that, if it was taken hold of immediately, the whole country could be cleared in a comparatively small time and at a comparatively small cost compared with the expense which has been incurred in Europe, where they have had the disease for a great many years. Doctors, however, differ in opinion in regard to the probabilities of the future of that disease. Some think it is already too widely disseminated, others think it is not. That is to be learned by experience.

Mr. Ware. I would like to inquire if the cause of the stock-yards people wishing the abolishment of the Bureau of Animal Industry was because they had taken action upon the matter? That is what I infer.

Mr. Cheever. My feeling is, that as they had fought them last winter, they did not want to recognize them this winter. Last year the cattle-yards people did not believe there was any pleuro-pneumonia in the country. They believed, or said that they did, that the veterinarians of the country are pretty much all quacks, and all they cared for was to get up an excitement, have commissions established to inspect cattle, and get a chance to spend a good many millions of dollars, part of which would go into their pockets. They denounced all legislation in favor of any cattle bureau, or anything of the kind, last year. Now they do not want to say that they were wrong, but they acknowledge that the disease exists, and that it ought to be stamped out. The meeting accepted that lecture or paper by Mr. Washburn, and was very thankful to see that he was converted.

Mr. Damon. It seems to me that when the question is put, it had better be divided. That this is a very serious danger to the cattle interest there can be no doubt; and on the two first resolutions, I do not think anybody can be in doubt how they shall act. As to the third resolution, I infer from Mr. Cheever's remarks and from the tone of the paper which was read at Chicago, in which this Bureau of Animal Industry was severely criticised, that there is a difference of opinion among those interested in the cattle business to a much greater extent than we are, as to the method which should be pursued. It seems to me it would be going out of our way to attempt to endorse any particular bureau. As far as asking national legislation to take hold of this matter and deal with it vigorously and root out the evil is concerned, there can none of us have any doubt; we all know how we should act and vote; but it seems to me that the methods and agencies to be employed should be left to Congress, and that we ought not to undertake to endorse any particular agency now in operation, unless it can be ascertained better than we yet know, that it is the proper agency to deal with the matter.

Capt. MOORE. I would ask if Mr. Cheever has any information which he has not communicated to us, or any information from Dr. Peters in reference to this subject, because before I vote I want to get what light I can upon it.

Mr. CHEEVER. With the permission of the meeting I will read Dr. Peters' report: —

To His Excellency GEORGE D. ROBINSON, *Governor of the Commonwealth of Massachusetts.*

SIR: — As delegates appointed by your Excellency to attend the National Cattle Growers' Association Convention, held at Chicago, Nov. 16th and 17th, 1886, we beg leave to submit the following report: —

The convention was held in the call-board room of the Board of Trade building, and was called to order at 2 P.M., November 16, by the Hon. D. W. Smith, about two hundred delegates being present, representing thirty States and Territories.

After the chair had appointed a committee on permanent organization and one on resolutions, Dr. J. W. Gadsden of Philadelphia read a paper on contagious pleuro-pneumonia, and Mr. Elmer Washburn of Chicago read an essay on "Necessary Legislation to get rid of Contagious Cattle Diseases." The latter referred more to contagious pleuro-pneumonia than to any other contagious animal disease, and recommended that the "Bureau of Animal Industry" be abolished and a national board of three cattle commissioners be established, to be appointed by the President of the United States. As Mr. Washburn represented the great stock-yard interests, it was easy to see that he favored a cattle commission that could be dictated to by the great corporations of the country, and the abolishment of the present "Bureau of Animal Industry," which consists of professional veterinarians, who would and could carry out the law, if any adequate national laws existed, for the control and suppression of contagious animal disease. The "Bureau of Animal Industry" is one capable of good work, and its loss would be greatly felt by the true live-stock interest of the country, besides nipping in the bud the scientific investigations now being made by its chief, Dr. Salmon.

After Mr. Washburn's paper, the committee on permanent organization reported the following list of officers, who were duly elected: President, D. W. Smith of Illinois; Vice-Presidents, Robert Mitchell of Indiana, Dr. George B. Loring of Massachusetts, J. M. Cary of Wyoming, J. W. Jennings of Texas; Secretaries, A. H. Sanders of Illinois and R. B. Harrison of Montana.

The meeting then adjourned until 9 A. M., Wednesday, November 17.

Wednesday morning a paper was read by Dr. D. E. Salmon, Chief of the Bureau of Animal Industry, on contagious pleuro-pneumonia and the efforts of the Bureau to stay its progress. During the day, papers were read by the following gentlemen: United States Senator Cullom on inter-state transportation, with especial reference to legislation by Congress, regulating railroad traffic in the interests of the people. The Marquis de Mora spoke on "Beef Producers and Consumers: How can they best be Brought Together." It was a plea for some system by which there might be fewer middlemen, so that cattle growers could get more for their animals and the consumer his beef at a more reasonable price than at present. Mr. J. D. Frankland of Toronto gave a history of the beef export business; he also spoke of the restrictions which England placed on the importation of American cattle, and said that they would not exist if we could only send them over with a clean bill of health; but that so long as contagious pleuro-pneumonia existed on this continent American cattle could not enter the British Kingdom except to be immediately slaughtered on the wharves.

The chief interest of the meeting seemed to centre in the fact that contagious pleuro-pneumonia was present in certain stables in the city of Chicago, the greatest live-stock market of the world; and that steps should be immediately taken for its extirpation. The dreaded disease, owing to the negligence of the Legislatures of the States where it has so long existed, has at last crept across the Alleghanies, and threatens the entire cattle industry of the West. The outbreak of contagious pleuro-pneumonia in Chicago is supposed to be confined to four distillery stables,—the Phœnix, Shufeldt, Chicago and Empire distilleries. These stables, which contain in the aggregate 2,500 or 3,000 head of cattle, have been quarantined by the Federal and State authorities, so that if there are no other infected centres the danger is not very great. Whether there are or are not other places where the disease exists, remains to be seen. There is no encouragement for owners of cattle to report cases to the authorities, as the place is only quarantined, while the cattle die and the owner gets no compensation. A milkman at the Shufeldt distillery stables said: "The present course pursued by the State is simply robbing us; if we were compensated for the slaughter of all diseased and exposed animals, we would do all in our power to aid the authorities in stamping it out."

Resolutions were adopted by the convention urging upon Congress the importance of national legislation and appropriations to eradicate contagious pleuro-pneumonia from the United States; and calling on the State and municipal governments to co-operate with the Federal authorities in their efforts to stamp it out. Massachusetts stamped out contagious pleuro-pneumonia herself, without any outside assistance, and it seems strange that other States cannot do likewise; but on the other hand, it is said that the trouble is assuming such proportions as to be of national importance, and that the governments of certain States have always been so apathetic in regard to the disease that it is doubtful if they can ever be made to take any action in regard to it; and that the land can never be ridded of it unless Congress assumes the responsibility of stamping it out, and that very soon, or it will be too late. Another influence which makes many desire the United States government to deal with the plague, is that the national treasury is overflowing with the means for carrying out the stamping-out process.

People may laugh at the cattle growers of the country, as they have laughed before, as a lot of "grangers" and "hay seeds"; but they should be educated to realize that every man, woman and child in the United States who ever uses beef, milk, butter, cheese, or even oleomargarine, has a personal interest at stake. Whether there is any danger to the live-stock interests of Massachusetts from the present outbreak in Chicago, we cannot say. There can be none from the dressed-beef trade, but there may be from the traffic in live cattle; and it would be as well if the live cattle brought from the West to this State came by some route avoiding Chicago. We would also advise regulations compelling railroad companies to disinfect and whitewash all cars used for conveying animals to our cities before allowing them to depart West for fresh supplies.

Respectfully submitted,

A. W. CHEEVER,
AUSTIN PETERS, D. V. S.

The CHAIRMAN. Gentlemen, you have heard this report of Dr. Peters; are there any further remarks to be made upon the motion that is before the meeting for the adoption of these resolutions?

Mr. DAMON. I move that the question be divided. The paper which has just been read has thrown some light upon the matter. I do not know why we should not endorse the Bureau of Animal Industry, but still I do not know why we should recommend any particular method of dealing with the matter.

Dr. LYNDE. I understand from the remarks which Mr. Cheever has made, and from the paper which he has read, that we here in Massachusetts are in very little danger from this disease; that we are only liable to it as it may be brought to us by cattle who have been exposed to it in Chicago; that the disease is not now in Massachusetts, and that the action which we take here is simply in co-operation with the action which has been taken in other States, with a view to securing national aid in managing this difficult subject.

Mr. Cheever. I should not quite assent to the idea that we have no direct interest in this matter. I think we have a direct interest. The point, as I see it, is this: Unless Congress passes a law by which the national government can go to work in this matter, it will be necessary for Massachusetts to do just what some thirteen other States have done, — put up their barrier, and say that no cattle from outside shall come in, on any condition whatever, from any section where this disease exists. It is in New York, it is in Maryland, it is in Pennsylvania, it is probably in Washington; and it has been in New York for thirty years, simply because the cattle trade is running towards New York instead of cattle being sent out from New York to breed. It is not spreading from there, but so long as the disease exists in the United States our beeves in England are worth dollars apiece less than they would be otherwise; and it is a matter that we are all personally interested in if we eat beef or use any of the products of beef animals. Massachusetts has a direct interest, and Massachusetts is allowing the unrestricted transportation of cattle from anywhere, practically, across her territory, and may get the disease here any day.

Dr. Lynde. I thank you for the explanation. I understand the subject clearly now. I do not oppose the resolutions, by any means; I am in favor of them; but I certainly did not have so clear an idea of what was intended to be accomplished by the resolutions as I have now, since Mr. Cheever has made his last remarks. I hope the resolutions will prevail.

The Chairman. There are three questions before us. These resolutions propose that the Secretary of this Board shall communicate the opinion of the Board of Agriculture to the President of the United States, and request him to ask for legislation for the management of this danger which threatens the country; also, that the Secretary of this Board communicate to our members of Congress their view of the necessity of immediate congressional action; and the third resolution looks to sustaining the Bureau of Animal Industry in opposition to the Chicago idea of the appointment of a cattle commission.

Mr. CHEEVER. That is not in the resolution.

The CHAIRMAN. But it is to assist the Bureau, now opposed by the Chicago interest.

When we adopt these resolutions we simply give our advice and our assistance in this matter. If we quarantine the State of Massachusetts against these cattle, we notify people of those infected districts to make themselves clean. The people of the West ask the general government to exercise powers that have never been granted to it in the Constitution. That is where the serious difficulty is going to be in this matter. The government of the United States can appropriate money through Congress for the purchase of cattle, and for their destruction; but it cannot go into any State and take any man's cattle, destroy them and pay him for them. That right does not exist; and that is the rock upon which this matter is going to split at the very outset. If we quarantine the State of Massachusetts against the cattle of Chicago, we thereby notify the people of Illinois that they must purge their State of this disease, as this State did years ago, — in 1861, '62 and '63, — at an enormous expense, without asking aid of the general government. We were poor then, comparatively: those people at the West are rich to-day, yet they are doing nothing for themselves; they are calling upon the government to exercise powers which must be granted before they can be exercised.

Mr. WARE. A quarantine to protect the State from importations from all directions seems to me impracticable. It strikes me that there is no other way of controlling this matter throughout the country except by the general government. If the general government has not the power to do it, perhaps by agitating this subject that power will be conceded. It certainly seems to me that that is the only thing that can be done. Illinois is unwilling as a State to take hold of it; other States have proved their unwillingness to do as Massachusetts did. I do not know how it can be met in any other way except through the general government. These resolutions, it seems to me, cover that point fully and effectively. In regard to endorsing the Bureau of Animal Industry, that some gentleman has objected to, by adopting the last resolution, according to the evidence that has come out here, that Bureau consists of experts, of veterinary surgeons, who are the only men, I suppose, that are capable of judging of the diseased condition of animals. If they are not, in whom else can we confide or upon whom else can we put the power of advising in such matters? As I understand, the Bureau is composed of those experts; and the very fact that those Chicago cattle-yard men oppose them because they have attended to their duty and exposed this condition of disease, it seems to me, is the very reason why we should endorse them. That seems to be the view of Dr. Peters. He is a veterinary surgeon. Perhaps some one will say that he is interested in his profession; but, acting under the direction of the Governor, I assume that he has made a fair statement and report, and I for one am willing to be governed by it. It seems to me it is wise to endorse by our recommendation the Bureau of Animal Industry, rather than take the chance of having it abolished and two or three men appointed by the President. I do not want to pass any judgment, but it strikes me this matter is safer in the hands in which it is now vested. I like that resolution and urge its adoption on that very ground.

Mr. Damon. I objected to the resolution in regard to the Bureau of Animal Industry being adopted, because I did not know anything about it; but I now know more about it since the paper was read, and of course I have no objection to it. In regard to the point which has been taken with respect to the constitutional power of the national government to interfere with the police regulations in the several States, I think it will do no harm to pass this resolution and let the national government go as far as it can in aiding the States in stamping out this terrible scourge which threatens the cattle interests of this country. The national government can appropriate money for this purpose, and the State of Illinois, for instance, may say what shall be done with the money. The people of Illinois may say, "Illinois has no interest in it; why should Illinois go to work and appropriate large amounts of money to prevent Massachusetts from suffering from this disease?" They may be willing to say, "We will make the police regulations if the national government will appropriate the money necessary to carry them into effect, and thus benefit all the States through which cattle run." It seems to me it will be best to pass the resolutions, notwithstanding the objection made in that respect.

The CHAIRMAN. I made the statement to bring into prominence the difference between quarantine action and waiting for government action. I wanted to bring the other remedy before the meeting, so that the question of quarantine, which seemed to be somewhat overlooked in the consideration of these resolutions, might also be brought into view.

Mr. WHEELER. I see no objection to the passage of the resolutions exactly as presented. We simply ask for action by the national government, implying, of course, that only such action will be taken as can be constitutionally taken. I do not see that we need hesitate at all on account of the objection that has been raised by the Chair as to the power of the government over the matter.

Mr. SLADE. I hope you will invite Professor Stockbridge to tell us what he is thinking about in respect to this matter.

Professor STOCKBRIDGE. This whole question of contagious pleuro-pneumonia among our cattle, the history of the disease in this country and its present aspect, is one which may be examined from a good many different standpoints. We shall find a great many dark spots about it, and it will be very difficult, I think, for us to see any rays of light which will enable us to inaugurate any practical measures to exterminate the disease. The fact is that we have not had a case of contagious pleuro-pneumonia in Massachusetts since the year 1864, and yet there has not been a year since then, up to within the last four weeks, when there have not been complaints made to the Cattle Commissioners of the outbreak of contagious pleuro-pneumonia in Massachusetts. They have had a very serious outbreak in the town of Brimfield within a month; that is, so far as the cattle owners and the selectmen of the town were concerned, they thought they had a serious outbreak of contagious pleuro-pneumonia there. There has not been a year, as I say, when the Cattle Commissioners have not heard complaints of cases of contagious pleuro-pneumonia. Ever since 1868 our Board have been cognizant of the fact that contagious pleuro-pneumonia was in the country; we have known it absolutely. We knew when it was among the swill-milk stables in New York in 1868, and soon after that it spread from those swill-milk stables to one of the counties in the southwestern part of Connecticut. Our Board were very much alarmed then because we were apprehensive that it would find its way into Massachusetts. We met the Commissioners of Connecticut, we made an examination of the case down there, and they got it out of Connecticut by running the cattle back into the State of New York and killing them just as they were taken out of the cars. There have been complaints during the last year that pleuro-pneumonia existed in the State of Connecticut, but I have every reason to believe that it was ordinary lung complaint, tuberculosis, or some form of pulmonary disease. But at the same time in all these years it has existed in Brooklyn, N. Y., and in the last four or five years it has made its appearance in Pennsylvania in different places, it has got into the District of Columbia, different places in Maryland, and finally it has found its way over the mountains to the West.

Now, the Massachusetts Board of Cattle Commissioners, knowing what has been going on in other States, have over and over again asked the Massachusetts Legislature to memorialize the Legislatures of New York, of New Jersey, of Pennsylvania and of Maryland in relation to this disease, because we knew what it was. The Legislature of Massachusetts apparently assumed that the Cattle Commissioners had got to make some kind of a report, and they might as well write that as anything else. You will find, by looking back in the Massachusetts Agricultural Reports, that year after year the Cattle Commissioners have called the attention of the Legislature to the fact that the genuine, old-fashioned, contagious pleuro-pneumonia that we stamped out existed in several States. We have known it, because we had communications with those men who have had the management of it. Most of you remember that it was an almost impossible thing in 1860, '61, '62 and '63 to convince the people of Massachusetts that the pneumonia that we had in Massachusetts at that time was contagious. When cattle were rotten with it in West Brookfield and other towns, some of the brightest men in the State insisted upon it that it was not contagious; and the only way that we convinced the public that it was contagious was by putting some of the leading advocates of the non-contagious character of the disease on that Cattle Commission, and compelling them to go to West Brookfield, Belmont and other places where it existed, and make their own examinations and experiments, and then they came out and acknowledged that it was contagious, and they stamped the thing out by killing the infected cattle. Now, they are going through that same change in the West. Some do not believe it is contagious, some believe it is contagious, and so it goes.

The Bureau of Animal Industry looked this matter over in the District of Columbia, in Maryland, in New Jersey, in Pennsylvania and in New York, having the feeling that there was no way of getting rid of it but to stamp it out as Massachusetts did. The Bureau of Animal Industry, with Dr. Salmon at its head, came to that conclusion. They immediately met with objections. Congress cannot go into Pennsylvania and stamp that disease out, but Congress — that is, the United States government — and the government of the State of Pennsylvania, acting together, can. That was the idea of the Bureau of Animal Industry. Let there be combined effort between the States and the general government and the two can stamp it out, but Congress cannot go there and do it. Now, I will state another constitutional objection before I go any further, which shows that all the States are to work together, and that is this: the State of Massachusetts cannot quarantine the cattle of the State of New York, only the general government can regulate internal commerce. The Cattle Commissioners of Massachusetts cannot issue an edict forbidding the cattle of the State of New York to come into Massachusetts. We cannot quarantine in that way. They may bring all the rotten cattle they please from any State outside of Massachusetts across our borders; we cannot tell them they shall not; it is utterly impossible. We tried that with Spanish fever. We passed a law here in Massachusetts saying that certain animals from Texas and the Plains should not come into Massachusetts; the State of Michigan passed a similar law; Kansas passed a similar law. We thought we were all right, but the cattle men rebelled against it, carried the question to the Supreme Court of the United States, and it was there declared that such a law was unconstitutional; that no State could tell another State, "You shall not bring your cattle into our territory." Massachusetts got over it in this way: they said, "You can bring your cattle in, but when you get them on to our territory we will seize and quarantine them. When they get on to our territory, then we can take them and do what seems to us good to do with them." That is the way our Massachusetts law is arranged. Men bringing cattle from Texas or the Plains are liable to bring Spanish fever, and our law says they shall not be driven on any road in Massachusetts, but shall be taken and slaughtered in Massachusetts immediately on their being unloaded from the cars. That is the way we manage them.

Here you have two constitutional points. One is, the United States government cannot go into the State of Pennsylvania and slaughter their cattle, but the United States government and the State of Pennsylvania can do it. The United States government and the State of Massachusetts can say to the cattle men, "Your cattle may come across the borders of the State and then we will encircle them, quarantine them, and if we find them infected we will kill them."

Now, this resolution in relation to the Bureau of Animal Industry is all right enough. The plan of that Board was to do this thing in conjunction with the governments of the States. The government of the United States is to pay the bills, and the several States are to make the laws.

I suppose the real object of this meeting was to get all possible information. I have not seen Mr. Cheever until now since he came from the West. I did not know what report he would bring to the Cattle Commissioners in regard to what the exigencies of the case required. We want to do what will surely protect us from this plague coming through from the West. The first thing we wanted to know was what our danger was. We had a meeting for this purpose early in October. We had no information excepting newspaper reports. We had a meeting in Boston and discussed the matter, and while we did not know anything, because the newspaper reports might be more or less true, we decided that we would write to Mr. Coleman, the Commissioner of Agriculture, and ask him certain questions, which was done; but we got no information; he did not answer the questions that we asked, except to say that Dr. Salmon and some others had been to Chicago, and it was their opinion that contagious pleuro-pneumonia existed there. What we wanted to know was whether the cattle that were driven from there were infected by contagious pleuro-pneumonia. We did not get that information. I then wrote to Dr. DeWolf of Chicago, — a Massachusetts man, a noted physician, whom a great many of you know, who is at the head of the Health Department of Chicago. I had seen in the papers that he had become interested in the contest, that he had condemned those distillery stables, and said their milk should not go into the market. The owners of the stables had said it should; the matter went before the courts, and the doctor won the day. So, supposing he knew all about it, I wrote him to see if he would give me any information; and, without taking time to go over his whole letter, I will say that he told where the disease broke out first, as far as he knew. He said the first information he had of its existence was on a certain farm about ten miles out from Chicago. A cow and calf were sick, and they were examined by a veterinary surgeon, who pronounced the disease contagious pleuro-pneumonia. They then went to work to find where the cow and calf came from. They tracked them to one of those distillery stables. Then they made an examination of those stables to see what the condition of the cattle in them was, and they found twenty or thirty animals which had come in connection with the disease, and slaughtered every one that proved to be diseased. Then he went on and detailed everything that had been done with the view of confining the disease where it was. He gave me an account of the regulations that had been made; stated that they had put officers there, that they had had the experts of the Bureau of Animal Industry there and they had securely enclosed it. The letter was dated the 25th of October, I think, and he said we need have no fear at that time that the disease, as they knew it there, would get into Massachusetts. The great trouble with them was to know what to do with it where it was. He said those cattle must all be slaughtered; those distillery buildings must be burned down: there was no question about it. They had shut the disease in on this farm that he spoke of; they had got it quarantined in the stables so that it could not get away; officers were on guard all the time, day and night; but the question was, "How are we going to stamp it out? We have no law in Illinois and no money." He advised that they commence to slaughter. He inspected the cattle carefully, and he said those cattle in the distillery stables were fat, in good condition for beef, very few of them infected with the disease. He made an inspection of them himself, and decided that probably nine-tenths of those cattle were good beef, perfectly healthy, and they ought to be killed and used for food; and he recommended, as the head of the Health Department, that those cattle be slaughtered and put upon the Chicago market as beef. But the packers then appeared on the scene, and another question arose, which was a question of sanitary importance, — the killing and eating of those cattle; and just as quick as the packers found that that was the proposition of the Health Department of Chicago, they said, "That won't do; it is going to affect our commercial interests. If it is known that those cattle in the distillery stables, several thousand of them, are to be killed and going into the market as food, it will ruin our packing business; there won't be anybody who will eat our dressed beef or our canned beef." The only thing we can do, he says, is to destroy those cattle, and the packers must raise a sum of money sufficient to pay for them. The matter hangs about there to-day between them. The packers do not raise the money; the State of Illinois has not appropriated the money, and they are holding those cattle there. They have men there who count those cattle, the doctor told me, twice every day, and I think now they are painting every one of them so that they can be detected; but they are simply holding them there because they do not know what to do with them, and of course if one of them should be killed and used for beef, although Dr. DeWolf says they are good beef, most of them, it would immediately raise an outcry that would have a serious effect upon the business of the packers. As far as I know there is no touch of the disease in Illinois or at the West, except in those distillery stables and on this one farm, where it has been closely quarantined. That is all the information I had before I came to this meeting to-night, to which has been added the information which Mr. Cheever and Dr. Peters have given us in relation to it.

What the Cattle Commissioners of Massachusetts want, is to know from the combined wisdom of this Board of Agriculture whether in their judgment we shall be justified to-day in taking any steps in this matter. If so, there is no trouble about the law; we have all the law we want to stamp out anything of this kind, if we can only find that the exigency of the case requires it. The question is, whether an exigency exists to-day that would make it our duty, in view of the public interest, to undertake to quarantine the cattle coming from the West on to our territory, either for slaughter or simply going through for shipment abroad. That is what we want to know. We are ready to act the moment we can get wisdom enough to act. We have got authority enough, if we only know what to do. We are on guard, that is all; but whether we shall strike before we see the enemy or not is the question. In the State of Connecticut they became alarmed; a meeting of the Commissioners was called about November, to which I was invited, and they took action which seemed to me to be unwise; I did not think it would amount to anything. They simply issued a notice, which was published in the daily papers of the State, that no sick cattle should be brought into the State of Connecticut. I don't know whether anybody wanted to bring in sick cattle there or had attempted to bring them in; but that was all the authorities did. The question was asked me what I thought about their action and if that was probably what the Cattle Commissioners of Massachusetts would do under similar circumstances. I said, without consulting with my colleagues, that when the exigency arose, we should quarantine every animal coming into the State, we should shut them close, for at least ninety days.

Mr. Bowditch. I think we are getting a good deal of information from the Cattle Commissioners. I would like to have Dr. Winchester express his ideas.

Dr. Winchester. There is one thing that has impressed me considerably in relation to this cattle traffic, and Dr. Peters has made some slight comment on that matter, and that is in regard to taking care of the cars in which these cattle are brought, and not only of the cars themselves, but of the excrement which comes from those cattle. It is well known that all the excrement and exhalations coming from cattle infected with pleuro-pneumonia contain the virus, and the period of the life of this virus varies very much according to the circumstances under which it exists. Now, taking into consideration the fact that the period of incubation is so long, there might be cattle brought into the State that had been exposed to contagious pleuro-pneumonia that would be out of the State before the disease manifested itself; and as most of the cattle brought here are shipped elsewhere, it would be advisable to have the excrements thoroughly disinfected, because manure and the sweepings of the cars have a sale and are taken to the farms, where the cattle would run great risks of contagion. So far as the disease itself is concerned, I think the nature of it is well understood. It is insidious, and the period of incubation varies.

The question was then put on Mr. Ware's motion to adopt the resolutions (Mr. Damon withdrawing his motion for a division), and they were adopted without dissent.

Dr. Winchester. There is another matter that I would like to bring to the notice of the Board. A great deal is said about contagious pleuro-pneumonia, which does not exist in this State, but we certainly have what many consider a contagious disease in this State, and no formal notice is taken of it; I refer to tuberculosis. It is one of the most insidious and hardest of all diseases to recognize, and the situation requires some action on the part of the Board of Agriculture. It is a hereditary disease. You can trace it from generation to generation, in direct descent. There is, also, no doubt about its transmissibility by the material which is thrown off from the lungs; and I have seen a case of supposed pleuro-pneumonia that proved to be tuberculosis. It is only a few days since I saw a herd of once fine animals rotten with tuberculosis. The owner said, "I wish you would tell me what to do." I said, "I cannot help you." I should like to hear some suggestions in regard to it.

Professor STOCKBRIDGE. The doctor has said what I intended to have said in regard to this matter of tuberculosis. That there has been such a disease in Massachusetts the Board of Cattle Commissioners have long known, but the veterinary colleges have never agreed upon the question whether it was contagious or not. There has been a long and somewhat acrimonious dispute in relation to it, and the consequence has been that the Cattle Commissioners have never recognized it or treated it as a contagious disease. We have always known that it was hereditary, and that it might be contagious, but we have never been prepared to say that it went by germs in the atmosphere, and in that way spread from herd to herd. But people are getting better educated in this matter, and I find that a majority are now coming to believe, and are acting upon the belief, that tuberculosis is not only contagious but infectious.

I hope that the Board, either at its present meeting or at their meeting in Boston, which will be held later, will ask the Legislature of Massachusetts to memorialize Congress on this subject. What we have voted to do here to-night is very well, but if we can induce the Massachusetts Legislature to memorialize Congress on this subject it will be a stronger appeal, and one to which Congress will listen.

The CHAIRMAN. If you are going to take such action it must be done at this meeting, because our annual meeting is not held until the 1st of February, and that would be too late for any action with a view to influence Congress, as that body dissolves on the 4th of March.

Professor STOCKBRIDGE. I will make a motion that the Secretary of the Massachusetts Board of Agriculture be requested to go before the Committee on Agriculture when the Legislature shall convene, and ask them to introduce a resolution into the Legislature to memorialize Congress on this subject. That is, I suppose, sufficiently definite. Of course I will risk it that the Secretary and the Committee on Agriculture can work up such a resolution as will pass.

The CHAIRMAN. The motion should be that the Secretary of the Board be instructed to co-operate with the Committee on Agriculture in procuring a memorial to Congress by our Legislature upon the matter of the extirpation of contagious pleuro-pneumonia.

Mr. UPTON. Why not include the Governor in the same way that in the other resolution the President of the United States is included? It will bring the matter more directly before the Legislature if the Governor presented it in his annual address, and then the Secretary can back him up by his petition to the Legislature.

Professor STOCKBRIDGE. I accept the suggestion.

The motion was then put and carried.

The CHAIRMAN. In regard to the matter upon which Dr. Winchester and Professor Stockbridge have spoken, that is, the matter of tuberculosis, I do not know why they should bring that matter before us, as one of the Commission has already stated that they have law enough to do whatever they choose in the management of contagious diseases in this State. If tuberculosis is contagious, they can act under the contagious disease law.

Mr. CHEEVER. It has been suggested a number of times within the past year or more that the cattle contagious disease law of the State has been growing through twenty years, more or less; that enactments have been made to fit certain cases that existed at a particular time; that experience has been gained at that time; but that the conditions have changed somewhat, and that the law is not only weak in some points, but quite cumbersome and incongruous. It has been suggested that the Board of Agriculture might do well, perhaps, to, in some way, put a word in the ear of the Governor to induce him to ask the Legislature to look into the cattle diseases law, and see if some legislation is not needed. There are sections in the law that it seems to me are decidedly objectionable. For instance, animals that have been taken notice of by the Board of Cattle Commissioners, that have been appraised, have had a stigma placed upon them; people are afraid to buy meat that has been under the hands of the Cattle Commissioners, because that points to contagious disease. The law specifies plainly that animals may be killed by authority of the Cattle Commission, under certain restrictions; they must be inspected and passed upon as being perfectly healthy, and then they may be sold on the market; but at the same time the law loads down the Commission with the responsibility of notifying whoever buys those dressed carcasses, which have passed inspection as being perfect, making them really safer to use than ordinary meat that has not been inspected, that that is Cattle Commissioners' meat. That spoils the buying. In my opinion that clause should be wiped out entirely, and there are other clauses which need some modification.

There is another point. The law is a double-headed law now, and Auditor Ladd objects to it very much in its present condition, and says it should be modified. The law says that the selectmen of the towns shall do such and such things in case of a contagious disease breaking out; they shall consult a veterinary surgeon or physician, and if he pronounces the disease contagious, they shall kill, and so on. Then, after going along seven sections or more, the law says a Cattle Commission may be created by the Governor, and when so created their regulations shall supersede those of the town or municipal authorities, and there comes a conflict between two organizations. The selectmen refuse to approve certain bills of the Commissioners, or perhaps refuse to approve certain bills which need the signatures of both. I do not wish to undertake to-night to go over the ground and tell what the law ought to be, but simply to suggest that suggestion be made to the Governor to call the attention of the Legislature to the law.

The Chairman. The more direct way to do it would be to introduce a resolution into the House asking for such a modification. That would be referred directly to the Committee on Agriculture, and it would be their duty to frame a bill.

Professor STOCKBRIDGE. We would like to have the Board of Agriculture suggest to us any modification of the law which would really suit their views of what the law ought to be. If no suggestions are made, the Cattle Commissioners will undoubtedly, in their report to the Legislature, make some suggestions. That report will be sent to the Committee on Agriculture, and under that the Committee on Agriculture can introduce just such a law as they wish. As has been stated, there is sometimes a little conflict, but nothing that ought to disturb us very much. Sometimes some men who are elected to their offices like to pay a pretty large sum for a man's sick horse; the Cattle Commissioners do not agree, and refuse to approve the bill. We think it is our duty to guard the State treasury, and there is no political object in this matter behind us.

Mr. UPTON. It seems to me that the Cattle Commissioners are just the men to go before the Committee of the Legislature and present their views on this subject. I have no doubt that the committee will see the necessity of modifying this law in such a way that it may be clearly understood and acted upon. I do not believe that any action is called for by this body. I think the Commissioners themselves are sufficient for the purpose of getting that law so amended as will meet their views from the experience we have had in these matters.

The meeting then adjourned.

PUBLIC MEETING OF THE BOARD AT BARRE.

PUBLIC MEETING OF THE BOARD AT BARRE.

The Country Meeting of the Board was held at Barre, November 30 and December 1 and 2, and much interest was manifested in the papers and discussions by large audiences. Secretary RUSSELL called the meeting to order at 9.30 A.M., on Tuesday, November 30, and spoke as follows: —

In calling this meeting to order, I wish to congratulate the Board upon this beautiful day, and upon the large attendance at our first assembly so early upon the first day. I look forward to one of the most successful and profitable meetings that the Board has ever held. As this is in a region that has the memory of what the Board has been in the habit of looking back to as the best meeting that was ever held in the State, when the great Agassiz was present and lectured with a power and acceptance that perhaps we shall never be able to experience again, I think that, later in our meeting, we shall have a very large attendance of the people of this region; but it is necessary for us to begin, as usual, with those of the Board who are present, and as a preliminary, I will call Mr. GODDARD, the chairman of the local committee, to the chair.

Mr. J. HENRY GODDARD of Barre took the chair and said: —

Gentlemen of the Board of Agriculture, — It becomes my agreeable duty at the present time to bid you welcome to this good old town, — a town which has not very much to be proud of, perhaps, unless it be her good soil and her crop of young men and women, — not absorbed by the home market, but year by year sent forth to supply new blood and energy to Worcester, Boston and other cities and large towns in this and other States, and perhaps the longevity of her people. A few years ago one of our citizens reached the great age of 104 years, and to-day another has attained the age of 100 years. I cherish the hope that your stay here may prove as pleasant to yourselves as it certainly will be profitable to those who may be in attendance upon your sessions.

The people of this town recall with pleasure the meetings held here by this Board fourteen years ago. When several members now present were here, and one other, now departed, whose genial and urbane presence, with his marvellous store of knowledge, did so much to render these meetings interesting and valuable, whose memory we of this town still cherish and revere, — the great and good Agassiz.

I well remember, also, during the closing session of that meeting, that on behalf of a committee of our citizens, whose pleasant duty it was to extend to the Board the hospitalities of the town, I referred to our lack of railroad communication which made it so inconvenient for you to reach us, the nearest station then being eight or nine miles distant, and inviting you to come again, with the assurance, which I verily thought I could give, that you would be brought over the Massachusetts Central Railroad. But, alas! that was not to be. Still I feel that the indications of progress are now so decided, that I am willing to promise that if you will come again next year we will furnish you transportation over the Central Massachusetts.

Gentlemen, on behalf of the Worcester County West Agricultural Society, whose home is to be your home for the next few days, I now have the honor of presenting to you the President of that society, the Hon. CHARLES A. GLEASON of New Braintree.

OPENING ADDRESS.

BY HON. CHAS. A. GLEASON OF NEW BRAINTREE.

Mr. President and Gentlemen of the Board of Agriculture,—It becomes my most agreeable duty in behalf of the Worcester West Agricultural Society to extend to you a most hearty and cordial welcome. Both officially and personally I bid you welcome,—personally, being acquainted with many members of the Board, having had legislative service with some, even committee work in the same room; officially, because I am sure I speak the sentiments and represent the feelings of the entire membership of the Society. It will be remembered when an invitation was extended to you at your meeting in Boston, by our honored chairman and myself, it was urged as a reason why the Board should come to Barre, that it was strictly an agricultural town, and that you would come into the midst of a large circle of intelligent farmers, who would gladly avail themselves of the benefit of this meeting. I trust that the interest and attendance at these meetings by the members of this Society will prove our statements and predictions true, and that your carefully prepared papers and able discussions will be listened to by men who can make a practical test of the new facts brought out. The enjoyment and profit derived from a former meeting in this place is still fresh in some of our minds and has been an incentive to ask you to come again. *Then* the stage-coach brought you a long distance. Since then the steam-car has wound its way among these hills, connecting us with the Fitchburg Road on the north and the Boston & Albany on the south, and now hope "long deferred" seems about to be realized that we shall have direct railroad connection with Boston and the eastern part of the State by way of the Massachusetts Central, so that while many of you came here indirectly by rail, at your next meeting here you can come directly from your own homes.

I desire very briefly to call your attention to a few facts in the history of the Society. It was incorporated in 1851, and for fourteen years held its fairs on the common in front of this hall, prospering under the able management of a class of energetic citizens, whose actions and decisions were but to insure success, until by increased expenses and competition of other societies, it was found to be necessary to secure grounds of their own, which were purchased and fitted up at a large expense in 1865, and have been used since then. The purchase of these grounds incurred a heavy debt which has been burdensome to the Society, but I am happy to say to-day, in the last few years it has been mostly extinguished. Being exclusively in a dairy region, our exhibition of dairy stock has been made a specialty, and has been among the largest and best of the State. The exhibition of grade and thoroughbred Holsteins and Jerseys entered entirely from this immediate vicinity has been the prominent feature of our fairs of late years. It gives me pleasure to speak of the increased interest in stock-raising, the increase of capital invested, and the improvement of many of our herds. Whichever way you go from this hall, east or west, north or south, you will find grazing farms on every hand, and many barns filled with thoroughbred stock. The farmers of this Society have always been noted for their excellent dairy stock; but in recent years a greater study and skill in breeding and greater care of the herds, will show to you some fine herds, which are owned by men who make farming a business, not a plaything, and who spend their money for a liberal return. I hope you may have the opportunity while you are here to visit some of these farms. Fifty years ago it was milk, and it is milk to-day; and while it is still the chief production of these farms, its use has entirely changed since the formation of this Society. We have made great changes in the methods of our farming and the manner of our living; farm machinery has been brought into use, but in this line there has been no greater change than in the disposition of milk. At that time every farm had its cheese-press, and every housewife had her reputation in Faneuil Hall market as a dairywoman. The manufacture of domestic cheese was large and was the chief income of this vicinity. Twelve years later came the cheese-factory, removing many of the burdens of dairy farming from the household, and for a series of years was the great receptacle for nearly all the milk produced. Thousands of tons of the best cheese ever made have been made in these factories (and I might say some that was not the best). But the competition of the great West and the decline of the foreign market has closed the last factory, and most of them have passed into other hands. Their day and generation has passed away, till now the cream-gatherer calls at our farms or the Boston milk-can is left at our doors. Through all these changes these farms have been pouring out their thousands of tons of milk every year, and whether made into butter, cheese, or sold as milk, has a reputation for quality surpassed by few sections. It has been raising milk in the past; it must be in the future. But with all the natural advantages of dairying these towns possess, both in the past and the present, it is carried on with discouragements and under many difficulties. Formerly it was our long distance from market. Within the memory of many here the entire produce of these towns was transported to Boston on four-horse teams; now the railroad has brought a market to our doors, but with it a competition which has almost threatened our existence. Every stalk of grain that is cultivated and every plant that grows has become the prey of some ravaging worm or insect, necessitating a constant war of destruction upon these pests. This soil, in its virgin fertility, which brought forth almost spontaneously, now requires heavy reinforcement with costly fertilizers. Incurable diseases attack our stock and oft-recurring midsummer drought render our crops a partial or total failure; and for these reasons the farmers of Massachusetts need all the encouragement they can receive from the local societies, all the help they can derive from your honorable Board in way of advancement of agricultural science, all the aid and protection they are entitled to by legislation; and they *must have* a resolute purpose, vigorous methods and business plans like other men, — yes, more than other men, — with industry and economy, and they will win success, as in the past, and these hills and valleys will still be fruitful. We have not only raised the fruits of the soil, but men who, as good citizens, have done honor to their native hills, — men of influence and power in our State and Nation, men whose loyalty and patriotism was never questioned in the day of our country's peril, and whose services and valor on the field of battle are an inheritance which will be handed down to succeeding generations.

My relation with the Board of Agriculture and the Agricultural College at the last session of the Legislature prompts me to congratulate the Board and the farmers of Massachusetts for what the College has done and is doing, its present good management and improved condition, and the promise of its increased efficiency in the future. I take pleasure in referring to some of its graduates, who are among our most progressive farmers. The names of Harwood, Smith, Barrett and Root of Barre, and Ayers of Oakham, are a credit to the College and an honor to their towns; and the College is ably represented on your Board by one who gives prominence to these meetings. As your Board reviews its history from its organization, you can but congratulate yourselves upon what it has accomplished. The influence that goes out from these meetings it is hard to estimate; addressed by leading agricultural men of the country on subjects of the greatest importance, awakening a spirit of investigation, and bringing you in close contact with so many communities, valuable results must have been obtained. The publication of your doings—sought for as no other State publication is, and scattered from Barnstable to Berkshire—is far-reaching in its influence, and is a prized volume by many a farmer.

This is probably the last country meeting of the Board under the presiding genius of the present Secretary. You, and the agricultural interests of Massachusetts, have drawn from him an inspiration that we can scarcely hope for from any man who may be his successor. His enthusiasm, zeal and devotion to his work have received the admiration and gratitude of all classes. His popularity has known no bound, and it has carried him to a broader field where he can make a national reputation.

This Society was formed by our fathers, earnest, resolute men. But few of them are alive to-day. It has been the centre around which have clustered many agricultural associations. For thirty-five years it has sought to stimulate a progressive state of farming by its exhibitions, discussions and dissemination of knowledge, and it has endeavored to fulfil its mission. We are glad to welcome you as the representatives of other similar societies; we are glad to welcome you as the highest authority of the State in all agricultural matters. We thank you for coming here, and trust we shall mutually enjoy this meeting.

The CHAIRMAN. Mr. Miller, who is announced on the programme to deliver a lecture on "Holstein Cattle in America," is not present, but the Secretary will read his paper.

Secretary RUSSELL. I very much regret, gentlemen of the Board, that Mr. Gerrit S. Miller of Peterborough, Madison County, N. Y., who was one of the earliest importers of Dutch cattle, could not be here to-day to read his own lecture, and to answer such questions as you will, perhaps, wish to ask at the conclusion of the reading; but there are others here to-day who are very much interested in the breeding of Dutch cattle, and who will be able to answer such questions.

HOLSTEIN CATTLE IN AMERICA.

BY GERRIT S. MILLER OF PETERBOROUGH, N. Y.

The cattle known in this country as Holsteins, Holstein-Friesians and Dutch Friesians, all come from that ancient and world-wide renowned dairy country commonly known as Holland.

Americans would do well to give these cattle their right name and call them "Holland cattle" hereafter.

There is probably no breed of imported cattle that has maintained its color, form, dairy and beef qualities through as many centuries as the Holstein, and for the purpose of fixing this fact in our minds it may be worth while to spend a few minutes in reviewing the history of this breed in its native land. The following extracts are taken from a translation of an article prepared for the "Nederlandsch Rundou Stambook" (Netherland Cattle Stock Book), published in 1875, the first herd book published in Holland: —

It may be settled as a fact that the pedigree of the Netherland cattle dates back farther than two thousand years; that they descend immediately from the cattle of the Frieslanders and Batavians, who, from three to one hundred years before Christ, populated the country north of the present large rivers, Waal and the Rhine, as well as the surrounding districts, and dealt there in cattle and fish, in so far as they were not forced to join the army against the Romans.

The animals were used for the production of milk, meat and hides. At the time of the hierarchy of the Romans, who were more regular in their tending of cattle, there was an improvement made, and better attention was paid to the feeding and tending of cattle, according to the way of the Romans, which is discernible even now in several distinctive usages on large country seats of the present day. In the old "Heerenhuis" (well fortified castle), with its multitudinous stablings for horses, in the immediate neighborhood whereof are promenades, kitchen gardens, cascades, fields, orchards, duck-ponds, canals, rivulets and ditches and the peasants' cottages, with their cow stables and granaries, all surrounded by a river ramification, we behold the image of an old Roman villa, with its appurtenances.

In the arrangement of these there is a change and decided improvement, yet, although possessions may have become somewhat smaller, everything points to an imitation of the Roman villas. It is important to notice this in order to understand thereby that for many centuries the stabling, feeding, tending, as well as the manner in which the animals were most profitably disposed of, have probably remained the same, and that, therefore, the cattle have received the same treatment in the same climate for all that length of time.

The same species interbreeding continually, with little or no adulteration from abroad, the identical breed remained naturally free from foreign elements. Notwithstanding the decrease of cattle through various causes, as floods, plagues and wars, breeding was still continued, and only *that class* introduced which was identical with the lowland breed; so that, through intermingling, right treatment and the fertility of the soil, the imported animals soon took on the inherent qualities of the home breed. The age and purity of the breed can thus be safely estimated at *two thousand years,* and the preservation of the form proper to the breed is owing entirely to climate, feeding, tending and practice having remained the same for hundreds of years. Hence the cattle have obtained a distinct type, or ground form, which through inheritance remains constant to itself. This form of body may be called the "milk shape."

Color.

About color, the following is to be remarked. Our cattle-keeping ancestors had many white, besides some red, black and red-spotted cattle. The white cattle of the Batavians are well known, as well as the white cows and oxen of later years, which were used as presents. In still later years the red-spotted bull and the dun-checkered cow of Paul Potter are well known, besides the ordinary piebald with black spots, and the black-pied cattle of Groningen, Friesland and North Holland. At present the black-pied has the pre-eminence in every variety.

Horns.

Another distinguishing mark of the Netherland cattle is the horns, which properly bring them in the class known as Short-horns. The direction of the horns is horizontal in front, rather inclining downwards than upwards; and this downward curving to the front, with Short-horns, is considered one of the most desirable signs of a profitable milch cow.

Flexibility.

Although these marks denote principally the physiological property of richness of milk, this does not exclude a disposition for fattening, which depends entirely on the manner in which the animals are bred, fed and tended, insomuch that a breeder has in a measure the power to make the animal what he chooses as most profitable to himself. This excellent disposition of our cattle to adapt themselves to circumstances, this tractableness or flexibility, although, as a general thing, proper to all races, belonging to the "Costaurus," is a great virtue belonging *particularly to them, and fits them better than any other breed to be safely transported to other lands, with little or no loss of their milk, meat and fat giving properties*, and enables them to be kept there; in a word, to be entirely acclimated there; witness whereof the cattle transported to France, Germany, Prussia and America. All these keep form, color and properties, and many have even more elegant shapes than our own indigenous animals. . . .

Instances of heavy cattle have ever been found in our country. *Fattened oxen* weighing 3,000 pounds have not been rare for three hundred years, nor cows which produced from 1,200 to 1,800 pounds of meat and fat. Young cattle, fattened by grazing or otherwise, produce flesh regularly interlarded with fat. This fat is interspersed all over in equal proportions between the tissues, and even somewhat accumulated in those places which contain the most fat when they are full grown. . . .

Finally, we can point to the excellent qualities of the products, milk, meat, butter and cheese. Our cattle belong to the best and most profitable of all known breeds and are to be preferred to all others, because these qualities are all united in one and the same individual specimen; so that a young heifer can be made equally well a valuable milch cow and a fat heavy animal, as after being milked she has the faculty of becoming weighty if rationally treated.

These two points of excellence, large milk producing and easy fattening qualities, united in the same animal, are more common than is generally known, and only an ill-advised self-interest would be able to render it less so by a too one-sided way of breeding, which, we hope, will be guarded against, in which case our cattle will not only retain these valuable properties, but they may be made more productive still.

The first importations of Holland cattle undoubtedly came to America with the early Holland settlers, and the effect of their superior dairy qualities has benefited many a generation down to the present day. Old farmers, in speaking of some famous milker of forty years ago, are very apt to say, "She was a real good, old-fashioned *Dutch cow*." The first accurate description of an importation of them is found in the Diary of Samuel S. Forman, one of the first who settled in Cazenovia in 1793. He describes this importation, sent out to John Lincklean, Agent of the Holland Land Company, at Cazenovia, Madison County, N. Y., in 1795. The description so well fits the Holstein of to-day, we give it verbatim: "About this time [1795] the Holland Land Company sent to Mr. Lincklean eight head of Dutch cattle, six of which were cows. The first winter after their arrival in New York I think they were kept in Bergen, in Jersey. The cows were the size of oxen; their colors were clear black and white, not spotted, but large patches of the two colors; very handsome bodies and straight limbs; horns middling size, but gracefully set; their necks were seemingly too slender to carry their heads; their disposition mild and docile. For some reason or other they did not do well and entirely ran out. Some supposed that the country was too new, the pasturage different from what they had been accustomed to. The company went to an enormous expense with these cattle. A groom was sent along for the express purpose of taking care of them."

It fell to the lot of the writer to make the next importation of cattle from Holland for Madison County, N. Y., seventy-five years later, and the description of the importation of the last century is an accurate one of the importation of 1869, with one exception; the animals imported in 1869 did remarkably well and exceeded all previous milk records made in that section of the State.

In Vol. I., H. H. B., the late Winthrop W. Chenery says: "Holstein cattle were introduced into this country about the year 1625, by the West India Company, and other importations were subsequently made into the State of New York by the early Dutch settlers there. At a later date, about 1810, the late Hon. Wm. Jarvis brought over a bull and two cows, which he placed on his farm in Weathersfield, Vermont, where they were bred successfully for a time and acquired a good local reputation; but several years previous to the death of Mr. Jarvis, in 1859, the pure blood of his importation became extinct."

Allen says: "The late Mr. Herman Le Roy of New York imported some improved Dutch cattle into that city and kept them on a farm in its vicinity. Some of them were, about the years 1827–29, sent to the farm of his son, the late Edward A. Le Roy, on the Genesee River in that State. We saw them and their produce there in 1833. They were large, well-shaped cattle, black and white in color and remarkable for their uncommon yield of milk. In the herds of both father and son the pure breed was lost. It is to be regretted that the blood of these importations should have been so soon lost by lack of interest in their propagation. They were of great value as dairy animals, as their qualities in that line were universally acknowledged where they were known."

The next importations were made by the late Winthrop W. Chenery of Belmont, Mass., in 1852, 1857, 1859 and 1861.

Mr. Chenery was the first to establish and maintain a purely bred herd of this valuable breed in America. The startling milk and butter records made by cows in his herd, viz., "Texellaar" (51, H. H. B.), 76 pounds, 5 ounces of milk in one day, 744 pounds 12 ounces in ten days, 4,018 pounds 14 ounces in sixty-three days and 17 pounds 14 ounces of butter in six days, together with the rapid growth and great weight attained by other individuals, viz., "Van Tromp" (50, H. H. B.), at six years old, weight 2,720 pounds; "Opperdoes 7th" (32, H. H. B), two years old, 1,597 pounds; "Lady Midwould" (17, H. H. B.), 1,620 pounds, created a very wide-spread interest in this breed, — an interest that has been growing wider and stronger ever since.

We are indebted to Mr. Chenery, not only for establishing a high reputation for Holsteins in this country, but also for giving us a herd book by means of which we have been able to keep the breed pure during the past twenty-five years.

The next importation, known as the Miller importation, was made in October, 1869. It consisted of a bull and three cows. They were kept on the farm of the writer in Peterborough, Madison County, N. Y., and there made the first annual Holstein records that were published in this country. "Dowager's" (7, H. H. B.) record of 12,681½ pounds in 365 days was considered a wonderful performance in those days. A few years later "Crown Princess" (6, H. H. B.) gave 14,027 pounds in one year and 76 pounds in one day. From this importation came such noted animals as "Rip Van Winkle" (35, H. H. B.), "Aegis" (69, H. H. B.), record, 90 pounds 6 ounces in one day, 16,823 pounds 10 ounces in one year, and 19 pounds 10¼ ounces of butter in seven days; "Aegis 2d" (235, H. H. B.), record, 79 pounds in one day, 17,943 pounds 2 ounces in one year, 23 pounds 7½ ounces of butter in seven days and 96 pounds 3½ ounces in thirty days; and "Echo" (121, H. H B.), who led the world with largest animal milk record for several years, and her record of 23,775 pounds still leads the records of American-bred cows.

During the next five years, 1870–75, importations were made by gentlemen living in Maine, Massachusetts, Rhode Island, New York and New Jersey. Among them was the Whiting importation, made conspicuous by the part it played in the long controversy that Mr. Whiting commenced regarding the use of the name "Holstein," as applied to this breed. In each of these importations there were animals of marked excellence for dairy purposes.

From 1875 to 1880 importations were made each year, in rather small lots; but during the next five years, 1880–85, thousands were imported for the Southern, Western, Middle and Eastern States. Finally the Hollanders began bringing their cattle to this country and selling them at a small advance. They were willing to do this business at so slight a profit that there was no longer any temptation in it for Americans, and the result is, Hollanders have imported most of the animals brought to this country during the past year or two.

In 1872 the "Association of Breeders of Thoroughbred Holstein Cattle" was formed, with Winthrop W. Chenery president, William A. Russell, C. C. Walworth and Thomas B. Wales, Jr., vice-presidents, and Charles Houghton secretary and treasurer. The first volume of the Holstein Herd Book, containing a record of the Holstein cattle in the United States, was published the same year. This was the first herd book for this breed ever published. It contained a record of 61 bulls and 67 cows; total, 128. The second volume was published in 1875, and carried the number of bulls to 171 and the number of cows to 234; total, 405. During the time that elapsed between the publication of these two volumes, the controversy over the name "Holstein" commenced and continued up to 1885, when the "Dutch Friesian Association" (an offspring of the controversy) and the "Holstein Association" joined forces under the name of "Holstein-Friesian Association."

Volume IX. of the Holstein Herd Book was published in 1885, ten years after Volume II. During that time the number of recorded animals increased from 405 to 15,224, a gain of 14,819.

The first volume of the Holstein-Friesian Herd Book records 5,687 animals. At the present time there are probably over 25,000 animals recorded in the Holstein, Dutch Friesian and Holstein-Friesian Herd Books. They have been tried in every State of the Union, the Territories, Canada, Nova Scotia, Mexico and Central America, and we have yet to learn of a single State where they have not proved a success. This is certainly a remarkable result, and speaks volumes for the general utility of the breed.

In the foregoing it is clearly shown that the Holstein has been noted for its excellence in the dairy and as a beef animal during many centuries.

It was no experiment for Americans to bring these cattle to this country and place them in their dairies; success was assured from the fact that the small country of Holland, in the year 1864, possessed about 900,000 milch cows, and during that year exported 32,000,000 pounds of butter and 61,000,000 pounds of cheese. The population of New York was about the same as that of Holland; the whole number of cattle of all sorts in that State in 1870 was about 700,000. The whole amount of butter exported from the United States from June, 1869, to June, 1870, was 2,039,488 pounds, and of cheese 47,296,323 pounds. There were undoubtedly as many milch cows in the United States as there were in Holland, and it is certain the Hollanders eat two or three times as much cheese, per capita, as the Americans do, and still Holland exported 43,664,189 pounds of butter and cheese more than we did. This result could not have been attained except for the pre-eminent fitness of Holland cows for the dairy.

During the past thirty years there has been more attention given to making careful experiments in feeding cattle for milk, butter, cheese and beef, than ever before, and by referring to the records of these tests and trials we are able to compare with considerable accuracy the merits, not only of individual animals, but of families and breeds. The first annual milk record made by a Holstein in this country was that of "Dowager" (7, H. H. B.), viz., 12,681½ pounds; this was sixteen years ago, and at that time was the largest annual record published of any cow, of any breed. Two or three years later "Crown Princess" (6, H. H. B.) gave 14,027 pounds in one year; then came "Maid of Twish" (1, D. F. H. B.), with a record of 15,969⅝ pounds, followed by "Lady Clifden" (159, H. H. B.), with a record of 16,275 pounds. Soon after this "Aaggie" (901, H. H. B.) surprised the world with a record of 18,004 pounds

15 ounces in one year; this was considered about the limit, but was soon followed by "Aaggie 2d" (1360, H. H. B.) with a record of 17,746 pounds 2 ounces, as a two years old. Then the famous "Echo" (121, H. H. B.) came to the front with a record of 18,120 pounds 8 ounces. During the next year, 1884, the annual record was beaten by "Violet" (743, H. H. B.), with a record of 18,677 pounds 4 ounces, soon followed by "Empress" (539, H. H. B.), with a record of 19,714¼ pounds; but "Echo" (121, H. H. B.) came to the front again with a record of 23,775½ pounds, thus beating best previous records two years in succession. Her last record remained at the head more than two years, until it was beaten by the wonderful "Clothilde" (1308, H. H. B.), with 26,021 pounds 2 ounces in one year. During all these years there was not a cow of any other breed able to equal the standard established by the Holstein, and it must be borne in mind that, numerically, the Holstein is a small minority among the dairy breeds in America.

In addition to these remarkable annual records, there have been equally surprising daily records made. Starting with "Texellaar" (51, H. H. B.), 76 pounds 5 ounces in one day, we have the following: "Johanna" (344, H. H. B.), 78 pounds; "Aaggie" (901, H. H. B.), 84¾ pounds; "Ondine" (828, H. H. B.), 90½ pounds; "Jantje" (2221, H. H. B.), 90½ pounds; "Lady Eva" (161 H. H. B.), 92 pounds; "Bexje" (6340, H. H. B.), 93½ pounds; "Mink" (702, H. H. B.), 96 pounds; "Rhoda" (434, H. H. B.), 96¾ pounds; "Copia" (1067, H. H. B.), 97 pounds; "Ethelha" (1208, H. H. B.), 101 pounds; "Sultana" (1032, H. H. B.), 101¼ pounds, and "Jamaica" (1336, H. H. B.), 112 pounds 2 ounces. Then there are many records made by two years' old heifers, such as "Aaggie 2d" (1360, H. H. B.), 61 pounds 5 ounces; "Tritomia" (4004, H. H. B.), 74½ pounds, and "Constance S." (3057, H. H. B.), 83 pounds. The list could be extended embracing many large records, but this is sufficient to establish the fact that the Holstein, as a milk producer, is the superior of all other dairy breeds.

Now let us consider the quality of this milk. It has been subjected to chemical analysis repeatedly with favorable results; but in these cases generally the milk of a few cows only was analyzed, and the result does not indicate quality for the whole breed as accurately as the more practical tests made with the cheese-vat and churn, using the milk of many cows. To begin with, we know Holland exports millions of pounds of butter annually, and this butter is frequently quoted at the highest price in English markets, competing with Jersey and Guernsey butter. We are told it has been sold for one dollar per pound. This is a good, wholesale indorsement for quality, as far as the Holland product is concerned.

In America many analyses of Holstein milk have been made, and inasmuch as the first one published is a fair criterion of all, we will refer to that one only. Winthrop W. Chenery sent four samples of milk from his Holsteins to Prof. A. A. Hayes, Massachusetts State Assayer, to be analyzed. Professor Hayes says: "The cans containing the evening milking of the cows reached me early on the following morning. Each can was sealed and accompanied by a certificate of Mr. George H. Nichols, superintendent of Mr. Chenery's farm, who had put the milk in the cans. On opening the cans immediately, the milk in each was found fresh and cool, and its delicate organization uninjured. All the samples at 60° F. were from one-half to one degree above the average of Orange County milk by lactometer.

"One thousand parts by volume afforded the following weights of constituents in samples:—

	No. 1.	No. 2.	No. 3.	No. 4.
	Texellaar.	Lady Midwould.	Zuider Zee.	Maid of Opperdoes.
Water (produced), . .	850.20	879.30	874.40	869.59
Caseine and albumen, .	55.40	38.15	48.01	49.68
Sugar and salt, . .	44.40	44.84	42.04	36.75
Pure butter, . . .	47.50	33.96	32.50	40.23
Phosphates, as bone phos.,	2.50	3.75	3.05	3.75
	1000.00	1000.00	1000.00	1000.00

"These milks, and especially No. 1, contain a larger quantity of albuminous matter than any samples which I have analyzed. This substance, found in all good milk, cannot be separated from the caseine so as to enable us to weigh it, and I have been compelled to include it with the caseine found. The albuminous substance is not only highly nutritious as a diet, but in the cases of the samples it confers a singular constitution on the milk, considered as an organized secretion. It divides the pure fatty part of the milk in a way to prevent it from rising in the form of cream copiously, and holds a part of it in what would be the skimmed milk, rendering it necessary, in order to obtain all the butter, that the milk, instead of the cream, should be churned. But its office has a more important connection with the actual nutritive power of the milk, which it increases greatly in two ways: 1st, It is itself a highly nitrogenized product. 2d, It is in these milks so balanced in connection with the butter as to be easily assimilated and digested without coagulation. These are valuable properties in their relation to the rearing of the young of the human or animal species, and I should expect to find these milks to possess fattening properties to an extraordinary degree, as indicated by the analysis."

These milks were also analyzed by Dr. C. T. Jackson of Boston, Mass., with similar results. And, for the purpose of comparison with European analyses of milk, he cites, in his report, analyses of cows' milk by Boussingault and Poggiale, and says, "By comparing the analysis of your cows' milk with theirs, you will perceive that your samples are richer than those analyzed by Boussingault and Poggiale, and you will also observe that the milk of your cows is specially adapted to making cheese, since it is unusually rich in caseine, which is the basis of cheese."

For practical tests we refer to the report of Mr. I. E. Grant, an owner of several butter and cheese factories in the best dairy section of Illinois. Mr. Grant says, "The dairies in this locality are composed of mixed grades and natives, the grades being chiefly of Short-horn, Ayrshire and Jersey crosses; and comparing them with dairies in the vicinity of my other factories farther north in this county, and those in the vicinity of Elgin, I think them fully up to the average.

Having the milk of the noted large herd of full-blood Holsteins imported by Geo. E. Brown & Co. of Aurora, among that of other patrons, I determined some time ago to institute a careful comparison of the Holstein milk with that of other dairies. We have noticed all summer that our testers (cream gauges) showed in favor of the Holstein milk, and therefore were prepared for the favorable showing in the recent experiments. I set the milk of Holstein cows (about fifty head) by itself, and in precisely the same manner as the other milk, the cream churned separately and the cheese also made by itself, and all in the same way, as I wished, for my own satisfaction, to make the trial strictly impartial. From 100 pounds of Holstein milk I averaged four and one-sixteenth pounds of butter and seven and forty-seven one-hundredths pounds of cheese. The butter was very firm and No. 1 in all respects, and the cheese of very superior quality. From my other milk I averaged three pounds of butter and seven pounds of cheese per 100 pounds of milk. The Holstein milk produced fourteen per cent. cream and the other eleven to twelve per cent. The Holstein milk is drawn three miles, and the other ranging from half a mile to four miles. In both cases the night and morning milk were mixed and re-set, and, of course, we could not gain as favorable results from either as we could have done if we had had the milk fresh from the cows; and I think that treatment operated more against the Holstein milk than against the other, for the reason that the Holstein milk is more dense than the other, and hence the cream would not again separate so readily; but this peculiarity in the Holstein milk is offset by another which I have noticed particularly—it is, that it is the best keeping milk I ever handled, therefore it can be held longer, a fact that ought to operate in its favor for marketing.

"Until recently I have had only a portion of the Messrs. Brown's Holstein milk, but so well am I satisfied with the quality of the milk for both butter and cheese, that I have contracted for the whole product, paying them the highest market price and a handsome bonus per cow, and we will do the same to others bringing us the same quality of milk."

Mr. S. Aiken of Decorah, Iowa, says, "I submit here-with a copy of a statement made this day by the inspector of the cream routes of Beard & Sons, which includes most of those who sell cream in this county, as well as a good many in Fillmore County, Minn., and some in Howard County, Ia. They operate three creameries in this county."

DECORAH, IOWA, Dec. 15, 1882.

This is to certify that as inspector for the creameries of Wm. Beard and Sons, I have inspected all the dairies contributing to said creameries, and I find the cream of Mr. S. Aikens' Holstein herd of cows fully equal in quantity to the average of other dairies on my routes, and I think superior in quality to any I have examined; have examined the milk in the early fall and again on this date. C. W. PILGRIM.

I, being the collector on the same route, fully corroborate the above statement of Mr. C. W. Pilgrim. T. A. BOYD.

The above tests are valuable because they were made by practical men of wide experience in the dairy business, comparing large quantities of Holstein milk with milk from good cows representing the dairy breeds, and their experience coincides with that of many other butter and cheese makers in different States of the Union.

A large number of Holsteins have made very creditable butter records during the past few years, but we will call attention to only a few of the prominent ones. First we have "Texellaar" (51, H. H. B.), with a record of 17 pounds 14 ounces in six days; then comes the champion butter cow "Mercedes" (723, H. H. B.), whose record of 99 pounds 6½ ounces in thirty days not only exceeded all previous records, but won the "Breeders' Gazette" cup, which was offered for the best thirty days' butter record made by any cow of any breed, between July 1, 1882, and July 1, 1883. In this trial "Mercedes" had as a competitor the famous Jersey cow, "Mary Ann of St. Lamberts," whose record came next to the Holsteins. "Overlooper" (1626, H. H. B.) has a record of 21 pounds 10 ounces in seven days; "Tietje 2d" (726, H. H. B.), 20 pounds; "Mink" (402, H. H. B.), 20 pounds 9 ounces; "Netherland Queen" (414, H. H. B.), 20 pounds; "Prairie Flower" (962, H. H. B.), 20 pounds 1 ounce; "Lily" (964, H. H. B.), 21 pounds 4½ ounces; "Georgie" (944, H. H. B.), 21 pounds 15½ ounces; "Oatka" (945, H. H. B.), 22 pounds 8½ ounces; "Sadie Vail" (958, H. H. B.), 21 pounds 10 ounces; "Star" (2345, H. H. B.), at two years old, made 15 pounds 13 ounces in seven days; and "Wanda" (2283, H. H. B.), at two years old, 16 pounds 15 ounces; "Princess of Wayne 3d" (1315, H. H. B.), at three years old, made 18 pounds 12 ounces in seven days and 76 pounds 12½ ounces in thirty days; "Aegis 2d" (235, H. H. B.), 23 pounds 7½ ounces in seven days and 96 pounds 3½ ounces in thirty days; "Neiltje Korndyke" (9, D. F. H. B.), 24½ pounds in seven days and 95¾ pounds in thirty days; "Princess of Wayne" (954, H. H. B.), 22 pounds 9 ounces in seven days and 91 pounds one-half ounce in thirty days. Several others have also made over 90 pounds of butter in thirty days.

We will close these records with calling attention to two marked performances: "Aaggie 2d" (1360, H. H. B.), as a five years' old, made 26 pounds 7 ounces of butter in seven days, 105 pounds 10½ ounces in thirty days and 304 pounds 5½ ounces in ninety days. This, we believe, is the largest amount of butter ever produced in ninety days by any cow. "Tritomia" (4004, H. H. B.), four years old, recently made 25 pounds of butter in seven days and 36 pounds in ten days. We think this leads all records for cows of this age. "Tritomia" has won other honors for Holsteins lately. At the Minnesota Fair a prize was offered for "cows giving milk from which the most butter is made." There were 8 registered Jerseys, 1 grade Jersey and 7 registered Holsteins competing. Mr. D. W. Curtis conducted the tests and the prize was won by "Tritomia." The Holsteins ranked, 1st, 2d, 3d, 4th, 5th, 7th and 8th, leaving the 6th place to a Jersey. This is certainly a conspicuous victory.

At the West Virginia Exposition and State Fair, last September, prizes were offered for best butter cows; the tests were made in the presence of a committee of the Fair Board and were conducted by Mr. P. H. Kimball of Vermont, an expert butter maker, selected to test the butter qualities of cows at this exhibition, comprising Holsteins, Friesians, Jerseys, Ayrshires and Red Norfolk Polls. The first prize for aged cows went to "Nora of Oatfield" (10,399, H. H. B.). First prize for two years' old heifers went to "Isidora" (985

H. F. H. B.), and second prize went to "Durkje V of Ohio" (H. F. H. B.).

Holstein butter has been awarded highest honors at many county and State fairs. At the American Dairy Show of 1885, prizes were offered for butter breeds of cattle. We copy from "Breeders' Gazette:" "The report of the American Dairy Show held in Chicago last November gives the following as the average score on butter made from the milk of several pure breeds of cattle competing. The awards were made by an expert, with the following scale of points: Flavor, 40; grain, 30; color, 15; salting, 10; style of packing, 5; total, 100.

BREED.	No. of Entries.	Flavor.	Grain.	Color.	Salting.	Style packing.	Total.
Jersey, ...	9	31	26	10	8	5	80
Holstein, . . .	3	33	27	11	8	3	82
Short-horn, . .	4	30	26	10	8	5	79
Hereford, . . .	1	32	25	10	7	5	79

"It will be seen that the butter from Holstein cows made the highest score, and exceeds that made by Jersey cows by two points. The Jersey butter was placed second by the judges, and the butter from Hereford and Short-horn cows takes the third place."

We call attention to the fact that the Holsteins scored four more points than the Jerseys on the items flavor, grain and color, losing two on the less important item, style of packing.

The foregoing testimony is convincing proof, and establishes the fact that the Holstein gives milk of good quality and is capable of producing as much butter as any breed.

There seems to be a degree of discomfort felt by some owners of the butter breeds, lest the Holstein should prove to be the greatest butter producer of them all, and I notice they are wont to console themselves by decrying the quality of Holstein milk, calling it "skim milk," etc. One prominent breeder, who writes frequently in the interest of his favorites, tells us he added water to the milk of his cows to make it equal in value to Holstein milk. In view of the butter records and tests mentioned above, would it not be wisdom on the part of such breeders to sell a portion of their cows and buy pumps in their stead?

We have considered the dairy feature of the Holstein quite thoroughly, now let us look at the beef feature. This breed is undoubtedly a corner-stone of the famous Shorthorn, the greatest of all beef breeds, and it makes more rapid growth than any other. Mature animals often weigh 2,500 to 3,000 pounds, two year olds, over 2,000 pounds and yearlings over 1,500 pounds. "Jaap 4th" (1337, H. H. B.) weighed at eleven months 1,200 pounds; "Emporium" (855, H. F. H. B.), at seven months, 850 pounds. A hardy constitution and mild disposition enables the Holstein to make such rapid gain. The quality of beef is excellent, the fat being well distributed through the lean.

While we regard this ability to make rapid growth and take on flesh readily, a very valuable feature in the breed, we hope there will be no attempt on the part of American breeders to make the beef feature of more importance than the dairy. The Holstein is pre-eminently fitted for the dairy, with an excellent beef combination; so let it remain.

The CHAIRMAN. Now, we have all the time there is, and we want to make the most of it. It is to be regretted that Mr. Miller is not here to answer the questions which might be propounded, unless the Secretary will stand in his place and undertake to answer questions. But there are many here interested in this breed of cattle, and I have no doubt that an interesting and profitable discussion may be carried on for about half an hour.

Mr. EDSON of Barnstable. We all know that Holsteins are much larger than Jersey cattle, consequently they must eat a great deal more. We should have a record of the food of these cattle and the food of the Jersey cattle, in order to ascertain which is the most profitable. We would not think of taking a factory with a thousand spindles and comparing the manufactured articles that come out of that factory with the articles that come out of one that has two thousand spindles. We all know the Holsteins are much larger and require a great deal more feed to produce more milk and butter than the Jerseys, which are not more than two-thirds the size of the Holsteins. It seems to me the paper lacks that one element.

Mr. Cushman of Lakeville. I would like to inquire of the last gentleman if he has ever fed Holsteins and Jerseys side by side in his stables and noted the extra quantity of food the Holsteins consume in comparison with the Jerseys?

Mr. Edson. I never have.

Mr. Cushman. I think the gentleman is not, perhaps, alone among the farmers of our Commonwealth in his impression that the Holstein breed consumes more hay and grain per hundred pounds of live weight than some of the other breeds, particularly the Jerseys. I must admit that my experience with this breed of cattle has been limited. Two years ago I wintered nineteen head of imported Holsteins, and I have now in my possession six thoroughbreds. It has always been my pleasure, wherever I have had an opportunity, to visit herds of this breed. I have taken great pains to converse with the owners, and I have noted individual animals in my own stable. I have to-day high-bred Jersey and Ayrshires standing by the side of two imported Holstein cows. I have failed to note that those thoroughbred imported cows have consumed more fodder than the cows of the other breeds. They certainly have not of grain, from the fact that they have had equal rations with the other cows. Those three-year-old Holstein cows that I imported are the two cows that are giving me more milk now than any other two cows out of twenty that stand in my stable.

It would be a waste of time to review the points that have been so admirably brought out in the paper to which we have listened, but perhaps I will dwell for a moment upon the idea that has always been prominent before the Massachusetts farmer, that there was no one cow that was the cow for all purposes. We are a beef-consuming people here in Massachusetts; we want something in a cow that shall make her valuable at the shambles after she has done well at the dairy. I believe that in the Holstein cow we come nearer to our ideal of such a cow than in any other one breed. It is folly for us to compare the Holstein cow with the Jersey cow in her butter-producing qualities, or with the Short-horn or Devon in her beef qualities. Those, gentlemen, are specialties of each of those breeds. But what the Holstein breeders claim, — and I believe, from my limited experience, that they claim it with justice and truth, — is that the Holstein cow combines the excellencies of those several breeds more fully than any other one breed. And, further, my observation and experience have proved to me that a Holstein cow will stand more abuse in her treatment than a cow of any other breed. You may say that that is not a redeeming quality, but those farmers before me who are obliged — and we all are who keep large dairies — to trust our animals to the care of inexperienced and careless men will appreciate its value. Is there a man here who has ever owned a herd of twenty cows of the Jersey or Ayrshire breed who has not had one or more of those animals rendered entirely worthless by ill-treatment? Now, a Holstein cow is remarkably patient. They are the best-dispositioned breed of animals that I have ever handled. They are quiet in the stable and in the pasture, and combine all the good qualities of all the breeds that I have ever had any experience with in a remarkable degree, and I have yet to be convinced that it takes more provender to produce a pound of butter or a quart of milk from a Holstein than from a cow of any other breed.

Mr. Ware of Marblehead. The question that has been broached is a very important one, and one that seems to be a mystery to all who have been in the habit of feeding beef or dairy cattle. That an animal so large as a Holstein cow will not consume substantially more food than a Jersey or Ayrshire cow, which is so much smaller, is surprising. Yet that is the testimony of the gentleman who has just taken his seat, and it is the testimony of a great may feeders and breeders of Holsteins with whom I have talked. At a meeting which was held a few weeks ago in Boston on the dairy question, Mr. Houghton of New Hampshire was present to advocate the breeding of Holstein cattle. He made a similar statement, and I asked him if he could account in any way for the fact stated, that a Holstein cow, which was so large, would not consume materially more food than these other animals. I do not mean weight for weight, but the animals themselves. This testimony we have had repeatedly; and, as I say, I asked Mr. Houghton if he could account for it. He said that from his information and observation he was decidedly of the opinion that the Holstein cattle had the power of greater assimilation of nutrition from the food they consumed. If that is the case, which observation seems to prove, it is one of the most remarkable and valuable features of the breed that has been developed, and it seems to me that that must be so. I remember visiting Mr. Chenery's stock at Belmont, the first importation, and the bulls there seemed to me very large. I said to the man who had them in charge, "You have got some very fine animals here apparently, and the amount of milk that you say those animals give" (he pointed to several) "is enormous; but," said I, "the amount of food that those animals consume must be in proportion to that great amount of milk." He told me then, very much to my surprise, and I did not then believe it, that those cows did not consume any more food than ordinary cows. I supposed he was there to advertise his stock, and made the statement for that purpose, and it did not have any effect upon me; but the evidence that has come to us from all quarters with regard to this breed of cows is such that I think we must take it as a fact that they do not require very much more food than ordinary cows; and this must be the reason, that they have the power of greater assimilation. Our veterinary surgeons ought to take hold of that point, our Experiment Station should work upon it, because it seems to me that it is a great matter for us to consider and decide.

All gentlemen who have had experience in feeding horses have observed this, that of two horses of equal size, doing the same work, one may require double the amount of grain to keep him in condition. I have observed it, and I have an illustration of it on my own farm at the present time. The explanation of that must be that one animal has greater power of assimilation of the food that it eats than another, and that makes one animal very much more valuable than another. I have in my stable at home two horses of about equal size, and one of them certainly requires double the amount of grain that the other does; but being a very valuable animal for doing all sorts of business, I prize that horse very highly, notwithstanding it takes such a large quantity of food to keep it in condition. It is because that animal does not assimilate its food as the other one does. It is more observable, I think, in horses than perhaps in any other animals that we feed. But here is the Holstein breed that is coming up and presents this remarkable fact (I think we must accept it as a fact), that they do not consume food in proportion to their size like other animals. They get along with less, and it must be on account of their greater ability to assimilate.

The CHAIRMAN. The principal object in keeping cows is to make money, I suppose. Now, in regard to this breed, there are a good many here that know something about it. There is a gentleman here who has just sold a cow for a thousand dollars. Some of the farmers would like to know how that is done. They would like to do it every day in the week if they could. I will call upon Mr. Harwood to tell us how it is done.

Mr. HARWOOD of Barre. The sale of that cow for a thousand dollars was as much a surprise to me as to anybody. The only thing about selling anything is, to have an article that is worth the price you ask for it; you will find a customer and get what you ask. If I had asked more I should have got it, probably. Of that I am not sure, but I am sure that it did not take me five minutes to sell that cow.

In regard to the amount of food required to keep Holsteins in comparison with Jerseys and other breeds, I will refer to a remark that was made to me by Mr. Youngmans, the elder, of the firm of Youngmans & Son, who owned the cow Aggie 2d, which, as has been reported, made just ninety pounds of milk a day for a year. Mr. Youngmans says, "I can easily believe that the amount of butter was made from that cow that is reported, but a more difficult matter to believe is that she only ate the amount of food which she is reported to have eaten." I have had some experience in feeding a cow which has made a greater record than Clothilde at the end of six months, which is as far as the record has gone. Koninger

Van Friesland 3d is reported to have made a record of 13,658$\frac{9}{16}$ pounds in six months, beating Clothilde by 250 pounds. She was sent to my place a year ago to be served, and was given sixteen pounds a day, half shorts and half ground oats. Another large cow alongside of her, that would weigh more than that cow, I have never been able to get to eat more than twelve quarts of that mixture in a day; and any one who has had experience in feeding knows that animals can fill themselves with shorts and ground oats with no material damage.

I do not know that any extended remarks on this subject could add to what has been already said. I very much regret that Mr. Miller is not present to-day, for he could present these points very much better than anybody else, as he has been a long time in the business. But I would say in regard to the statements which he has made, that I think they can all be verified. I have had the pleasure of becoming acquainted with the members of the Holstein-Friesian Association very generally, and if there is any confidence to be placed in men of large means, high character and reputation, those men are entitled to our confidence. I know of no men of whose acquaintance I am more proud than of that of the members of the Holstein-Friesian Association.

There is one record which has been reported possibly since Mr. Miller wrote his paper. Judge Dallas P. Whipple of Cuba, N. Y., reports that the cow Nierop (2519, H. H. B.) has given 116 pounds in one day.

The CHAIRMAN. I understand there is a gentleman present whom many of us know by reputation, and from whom we should all be glad to hear. I refer to Mr. Houghton of Putney, Vt.

Mr. HOUGHTON. I think that all that can be said in favor of the Holstein breed has been said. We claim for them all the good qualities that can be claimed for any breed. I can only regret that Mr. Miller is not present. He has been abroad and might give us an interesting account of his experiences in Holland. I suppose what you want to hear about is whether there is any profit in keeping Holstein cattle. At a Farmers' Meeting which I attended and to which Mr. Ware made reference in his remarks, Dr. Loring made a statement to the effect that we had about reached the limit of the profitable production of milk; that it was no longer of any use to keep a cow with a view to profit from her milk, but simply to keep our farms in order and make our lands rich. Well, I made the remark there, that if people thought they could not realize any profit from keeping ordinary cows, I hoped they would at least give the Holstein cow a trial before they gave up. I think I may offer the same advice to the gentlemen here present, although I do not believe they are in any such condition as Dr. Loring described most of the farmers of New England to be in with regard to the raising of milk.

Mr. BARRUS of Goshen. There are always two sides to a question. I know in my own town a gentleman imported, in 1873 or 1874, two Holstein cows and a bull. One of the two cows would give from thirty to forty quarts per day. I do not know what it would weigh; probably from sixty-five to eighty pounds. But that milk was good for nothing, comparatively, for butter. You could hardly get any butter from the milk of either of the cows; what you did get was very poor indeed. The milk was good. One of those cows was sold in Northampton, and the man kept her for a milch cow, and she yielded the best of any cow that he had until she was seventeen years old. He killed her last fall.

As far as the quiet nature of the animals is concerned, I will say that I bought two imported bulls, one imported by the gentleman to whom I have referred, and the other by the Shakers of Enfield. They were in the market for a long time, and I bought them at six years old. The pair weighed 3,800 pounds. There was very little difference in their weight. I paid a hundred dollars for them; one of them was very vicious: it was as much as a man's life was worth to take care of him. Our people have gone out of that breed. They took their cows to those bulls, and there was quite a large number that got into that stock to a considerable extent, but, as I say, they have all dropped them, with one exception. Aside from that one herd, I do not know of a single animal in our section of the country, although they were distributed largely around in three or four towns there.

Mr. UPTON of Adams. I do not want to take up much time, but I would like to say a word upon this question of feeding. I have never had anything to do with Holsteins, but I have with other breeds and with grade Jerseys and grade Ayrshires, and so I can say that I have had some experience in the feeding of cattle. Last week I slaughtered a grade Jersey cow; she was a small cow, and I had a large thoroughbred standing in the same stable, that looked very large in comparison; but this little cow would eat more food than any other cow I ever saw in my life. I wondered where she put it all. Her beef has cost me all of fifteen cents a pound in her feed. My experience has been that those little cattle will stow away as much food as any large cattle. I could not account for it. But I think the explanation our friend Ware has given is the true one.

A small horse that I had, weighing not more than nine hundred pounds, would eat more than any other horse in my stable to keep in fair condition. Then I have had larger horses that required less food to keep them in first-rate condition. I think the statement that has been made here is true, that it does not cost much more to keep a large animal than a small one. I have had fifty years' experience with different breeds of cattle and horses, so I think I know whereof I speak.

Mr. Houghton. I would like to ask the gentleman who spoke of those ugly bulls if they were Holsteins.

Mr. Barrus. Yes, sir.

Mr. Houghton. By whom were they imported?

Mr. Barrus. One by the innocent Shakers of Enfield, and the other by C. W. Adams of Goshen. I believe he is now somewhere in the South.

Mr. Houghton. Were they handled in the ordinary way we handle cattle?

Mr. Barrus. I cannot tell how they were handled previous to their coming here, but I know that the man had a foreman on his farm that I wouldn't want to handle my cattle.

Mr. Houghton. That goes a long ways towards an explanation. Of course we have exceptions in this breed as well as in all others. We have occasionally an ugly animal. I have a six-year-old bull now that weighs 2,500 pounds, that I lead around by a nose-ring; I would not advise a stranger to do it, but it seems a perfectly proper thing for me to do, because I know the animal. I think that case is entirely exceptional. I think if you will look at the way they handle those cattle in Holland, you will find that they are generally docile, or the Hollanders would not be apt to live with them as they do. Their living-room extends right into the stable, and they always take great care of the cattle. They would not be likely to live with them in that way if they were an ugly breed. Therefore I think that the case of the Enfield cattle must be an exception.

BEEF FATTENING FOR THE NEW ENGLAND MARKET.

BY JOSEPH A. TITUS OF WORCESTER, MASS.

I wish to say before reading my paper, that after listening to the paper which has been read, it appeared to me that my remarks might be somewhat less interesting, for the reason that I cannot give details of the results, but as far as I know, the attention of our farmers and agriculturists has not been turned to the subject of fattening beef for our market to any great extent, and I do not know that it ever will be; but it is my purpose in the paper that I propose to read, to throw out some ideas which may lead to some experiments.

This title will doubtless cause a feeling of surprise in any audience inside or outside New England.

The easy and cheap production of beef in the West has produced an opinion that cattle-grazing on our hills is a thing of the past, and an industry in which we of New England have no practical interest. That there can be any pecuniary return for it, is a matter which generally has no supporters.

Among our younger farmers and land-owners, the fact that until within a comparatively short time New England raised her own beef is almost unknown. Such, however, is the fact, although it is not my purpose to attempt to show that she can ever do the same thing again.

Mr. W. B. Von Richthofen has written a very interesting and instructive work on "Cattle-Raising on the Plains"; but while reading his book and endorsing his position as to the great profit to be secured by those engaged in the business of cattle-*raising*, we must not forget that he has not touched upon the theme which I propose to discuss at this time.

He says of cattle-raising in the East, "The Eastern and Middle States show a rapid decrease of cattle. The land there is too dear to make the business of raising cattle profitable, and it pays the farmer better to turn all his attention to the cultivation of cereals and vegetables.

"Although he will always be obliged to raise a few cattle, he has already given up the idea of profitably raising herds, for he remembers that he must pay for his pasture from fifty to one hundred dollars per acre, and must raise hay and fodder for his cattle, and that he has to compete with the herds raised out West on pastures formerly worth nothing, and now perhaps only two or three dollars per acre, on which cattle thrive and fatten winter and summer without shelter."

We all subscribe to this summing up of the question of comparison of the East and the West for cattle-raising. But read Mr. Richthofen's book through, and you find no claim that the cattle raised in this Western cattle El Dorado, on this cheap soil, can be marketed in New England as good wholesome beef, whether on the hoof or slaughtered.

Our discussion relates to the subject of procuring good, palatable beef for our own consumption.

Now passing the epoch of Eastern cattle-*raising* let us for a moment take up the period with which most of us are familiar, when Western cattle-raising became established, and the New England market was supplied with Western cattle shipped alive and slaughtered here.

Were there any *difficulties* attending that system? Did we get good, wholesome beef?

Mankind is so organized that the appetite for food demands the best quality and the most exquisite flavor. Once the taste has become settled upon the normal flavor of vegetable, fruit or meat, it is not satisfied with any imitation or any fault in the quality of food.

Oleomargarine is not butter, chiccory is not coffee, nor is tainted meat tolerable, or meat which has, by chemical process or faulty preparation, been deteriorated in quality.

But much more do we reject food which from any cause is unwholesome or contains the germs of poison, thereby being and becoming dangerous and destructive of health, and sometimes of life itself.

As it is so recently that the method of freighting to our markets refrigerated beef, slaughtered in the West, has been adopted, I may fairly assume that nearly all of my hearers well remember the evils of the method first alluded to; that is, the freighting of live cattle to our markets.

The cattle reached us exhausted, bruised, fevered, with all the delicious flavor and most of the nutriment of the flesh extracted by natural absorption, which is nature's method of furnishing sustenance to the animal when outside nourishment is withdrawn.

Against this system the individual revolted, society revolted and the State revolted.

The Legislatures of several States decreed that cattle shippers should furnish food and water to the cattle while being transported through the borders of the several States so legislating.

These laws turned the attention of the inventors to some device for cattle transportation which would in the best and cheapest way furnish food and water for the cattle.

I well remember seeing, some dozen years ago, a car load of fourteen Texas steers unloaded at Washington Square in Worcester, which had been shipped from Chicago in Aldrich's compartment cattle car. They had been fed and watered at regular intervals throughout the journey. There was not a chafe or bruise upon them. They had shrunk in weight not exceeding twelve pounds to the steer, and when they found themselves once more on *terra firma* they were as frisky as when standing on their native turf.

The success of the experiments was complete, for I may add that I tasted the meat and found it as good as the best home-fattened beef.

Meanwhile these experiments were being made for feeding cattle *in transitu*. Calculations were also being made and experiments tried for slaughtering the cattle West and sending the carcasses in a frozen condition.

The expense of sending the cattle alive, and feeding and watering them on the cars, was found to be greater than that of sending the carcasses, or else the enterprise of the advocates of the latter method outstripped their competitors. In any event, for the past few years we have been provided with beef shipped in refrigerating cars.

What has been our experience? Are we better off than under the old way? I say no. Do you ask why? I reply, at the present time the cattle slaughtered in Chicago must be got to the slaughter-houses from Texas and the Eastern slopes of the Rocky Mountains, largely.

To reach their destination, most of them are driven and carried as far, or farther, than under the old plan when cattle were shipped from Chicago to Brighton, and they reach Chicago in the same or a similar exhausted and diseased condition as we found them in at Brighton. In that condition they are killed at Chicago and then frozen and sent on to us.

Now if this frozen beef should undergo no further change, we might congratulate ourselves on receiving our beef killed and dressed at our very doors. But here our difficulties commence again.

This beef, so prepared for our market, must of necessity be handled by the wholesaler and the retailer. It must be more or less exposed to the air and to a higher temperature, and consequently undergo chemical changes not favorable to the preservation of its quality and flavor.

The truth of my position can be fully ascertained by the careful inspection of the beef at the city meat-stalls, first, as to the condition of the animal when killed. Of course the carcasses vary, but a large majority of them clearly show no evidence that the animals were fat and in proper condition when killed. It is not necessary to particularize as to the indubitable proofs of fat beef. Every one familiar with beet knows those peculiar indications of tender and well-flavored beef.

The marketman will occasionally point with pride to the round of beef which needs no encomium to recommend it to the purchaser. Such meat sells itself. Its flavor is distributed throughout, like plums in a Thanksgiving pudding.

But how much of such beef is ever received from Chicago? As a housekeeper for eighteen years I have seen but little of it.

After talking with most of the retailers of my acquaintance on the subject, I have found that, almost without exception, they acknowledge the inferiority of the beef now in market from the West. A few have not given attention to the matter, and some are so young in the business and in years, that they are ignorant of the true type of the beef of our fathers.

I will venture the assertion that any city boy or man, who is blessed with a discriminating taste, will at once discover the difference between home-fattened beef and Chicago beef. I have had some of the latter which my dog could not be persuaded to eat, and some so much worse than that, that it has been buried in the earth to prevent the creation of a nuisance in the neighborhood.

This has come about in this way. The retailer has, most of the time, pieces of meat, *never inviting* to his customers, which lie in his refrigerator or on his bench, often shifted from one place to another, until at length, to save them from utter loss, and thinking that a strong brine might conceal their age or renew their youth, he has transferred them to the corning vat and sold them for corned beef. They deceive the best of us, while in the market; but once put them into the kettle and attempt to cook them, the deception vanishes. They speak for themselves, and declare, in never-to-be-mistaken language, that between themselves and the human family there is no possible affinity.

I could cite facts in regard to this Western beef as now delivered to us, which, while startling, would only go to show that under the most favorable conditions our beef is not what is good, or at least the best, for consumption.

I shall not attempt to explain the chemical changes that take place in this Western beef after it is first frozen. I leave that to another occasion and to the investigations of an expert scientist, and would be glad, for curiosity's sake, to have written down, for my rapt contemplation, the chemical history of some beef which has fallen under my observation.

But, you say, " Why this condemnation of our food, which must be our subsistence, whether or no?"

Can you suggest a remedy? Is there any help for us?

I am here to make some suggestions, which are the result of much thought and inquiry, and which I offer not as a developed and patented scheme, but rather as food for your consideration, and perhaps tending to lead to some useful and practicalsolution of the question as to how we may be able to have wholesome and nutritious beef for consumption.

I will say at this point, that the first thing that attracted my attention to any remedy for the evil I have referred to was the recital to me of certain facts relating to the disposition of unmarketable cattle brought to Brighton from Chicago.

It appeared that a gentleman in this county, possessed of considerable pasture land, has been for some years in the habit of buying at Brighton these unmarketable cattle, that is, cattle that arrived in a bruised and somewhat diseased condition, and driving them to his pastures for a few weeks pasturing. That the enterprise had been lucrative to himself, and that he was thereby enabled to furnish fat and rich meat, which commanded the best price.

On reflection it occurred to me that if private enterprise could succeed in this business, capital might be invested to good advantage on a larger scale.

On further inquiry I found that there were others in the same business on a limited scale, but with uniform success. Further inquiry satisfied me that this enterprise must be an important one, and that beef so produced will command the best price in the market and would, so far as it could be produced, supplant the inferior quality.

These conclusions led next to the inquiry, Can grazing be found for cattle for our home markets?

If the business is lucrative on a small scale, ingenuity and enterprise can certainly carry it to the limit of our capacity for grazing the cattle. Every one will admit that, I believe.

Remember Mr. Richthofen says, "Land is too dear to make the business of raising cattle (in the East) profitable, and it pays the farmer *better* to turn his attention to the cultivation of cereals and vegetables."

Perhaps he was not meaning our New England land; if he *was*, let us remember that when the great West was opened for cattle-raising, and our farmers mostly withdrew their cattle herds from the hill-tops, they *did not* turn their attention generally to the raising of cereals and vegetables. The great cry to-day in New England is, "Our farmers are going West and to the cities, and our farms are being abandoned and left to relapse into the condition of nature."

And let me ask, Shall all this territory, once cleared up and producing a respectable and easy living to so many thousands, be allowed to grow up to worthless weeds and brush, while there is a demand for pasturage which will yield a handsome revenue?

I can perhaps convey an intelligible answer to this inquiry by stating that the pasturing used by some of the gentlemen I have discovered engaged in fattening beef for our own market was and is some of these very abandoned farms.

And these farms have furnished not only the grazing for cattle, but also some fodder for winter feeding, and shelter to some extent, so that the business has not been entirely confined to the warm, summer months.

Inquiry has furnished ample evidence that thousands of acres of good grazing land can be purchased in New England at much less cost than estimated by Mr. Von Richthofen, including much formerly improved land now lying fallow, on which this business of fattening cattle can be profitably prosecuted.

I have in mind, at this time, large areas of good pasturage on which I have seen young cattle grazing, and have found them in excellent condition year after year, as I have visited the same localities in search of rest and recreation on the trout brooks among our New England hills.

On these trips I have not omitted to inquire the price at which these lands are held, and have often been surprised to learn how cheaply from one hundred acres to five hundred or seven hundred acres could be purchased.

Often I have been informed that the owners were living in some far distant city and would be glad to dispose of their lands, but there were no purchasers. This and many other facts have strengthened my belief in the perfect feasibility of establishing a lucrative business in beef-fattening, which will supply to some extent the growing demand for better beef for home consumption.

We are doing much in New England in the way of procuring the best quality of butter, cheese, fruit, eggs, poultry and vegetables. Can we afford to live on poor beef? I am aware that many families are, of late, using much less beef than formerly, and yet I am satisfied that the chief reason is that the quality of the beef in our city markets is so inferior, that a substitute is sought in all directions.

In Worcester there is one retail beef-dealer who slaughters much of the beef sold at his stall. He is well known as a purchaser of fat cattle. I have seen him driving through the streets magnificent fat oxen and have seen him accosted by consumers inquiring when those cattle would be slaughtered and for sale. His trade is the best, and his customers are assured of the full value of their money when they buy his beef. Perhaps you inquire, "Where are these acres of good pasturing you refer to? Are they not at a great distance from railroads and the markets?"

My reply is, I can reach some of them from my own home in two hours' railroad travel and an hour's drive, and some of them in less time.

And you ask, "Have you any plan for the development of the proposed industry?"

I answer, I have made no experiments myself, but I have already given you the results which individuals have wrought out; and I have outlined to friends, who have become interested in the matter, plans for trial which have met their approval, and a promise of substantial co-operation whenever the time should arrive when capitalists would invest in an experiment on a sufficient scale to secure a supply of Western cattle for the work, and to establish a supply for a respectably large market.

No one who has given candid consideration to the subject has ever condemned the idea as chimerical or discouraging.

We must bear in mind that while beef-raising in the West, and transportation and handling, are all done on such a stupendous scale, beef-fattening in the East cannot go on three legs.

Land must be secured, transportation must be at hand, facilities for shelter must be devised, calculations for fodder must be made, and last, but not least, the Western cattle-raiser must be brought into the work to furnish us with the cattle, and to take his share of the profit in this *to be* lucrative business.

Take Richthofen's tables of profits and the experience of Western cattle-raisers, and tell me, would our Western capitalist reject an opportunity to co-operate in a business which would insure the certain sale of his stock to consumers who are now gradually learning to avoid and despise Western beef?

A Western cattle-raiser told me that during the last ten years he has been able to raise steers and sell them at his ranch, at three years old, for fifteen dollars per head, and *make money.* The market price was from twenty-eight to forty dollars per head, yet he *could* have made money and sell them for fifteen dollars.

As the price of land increases in the West, and the expense of raising cattle increases proportionately, every cattle-raiser will see the importance of being able to furnish to the consumer beef which will be faultless, and which will command a ready sale at a good price.

New England adaptive genius and thrift will not allow our farms and pastures to drift into wild waste and barrenness, when they can be so easily diverted to a lucrative use and occupation to serve a growing demand for an article which they, and they alone in all human probability, can successfully furnish.

It is not for the reason that I have no faith in the future success of New England beef-fattening that I do not, and cannot, submit the details of a successful plan of operation.

The burdens under which the people of New England suffer in the matter of their beef-eating have not yet, perhaps, become *intolerable;* prejudice has not been broken down. The possibilities of our resources have not yet been considered and appreciated.

But in my judgment the time is not far distant when we, or those who shall come after us, shall see, not in imagination, but *in fact,* the cattle on our thousand hills.

We, or they, will see our forsaken soil rejuvenated. The busy hum of a new industry will echo from hill-top to hill-top, and the intervales will blossom as the rose.

The rich fruits of this new industry will be garnered by happy laborers, and will be sent through the channels of commerce to markets which now are growing shy of the makeshift methods and poor expedients for unloading the fruits of a far-removed feeding ground upon the dissatisfied consumers of Western beef.

Let the West and the East unite their forces and their resources. Let the Western grain-grower become a partner in this projected enterprise; he too may help to make this industry a success, and if he shall do so, then let him reap his share of the profits.

In this day of co-operative labor and division of profits, let the experiment be made of uniting the forces of nature and circumstantial necessity, and bring out the greatest and most benign results.

If my position in this matter is tenable and my deductions are correct, why may we not be able to provide for our market as good beef as the world affords?

Any one adopting these views and firmly believing in the final success of a fair experiment, supported by sufficient capital and wise and liberal management, will find himself face to face with a question of the details of the operations.

Such a one can easily ascertain whether beef fattened as I suggest will find a ready sale in our city markets. He can also satisfy himself as to whether there are abandoned farms which can be purchased at a fair, not to say a very low price; and for a fair experiment he will learn the importance of providing as large a pasture, lying together, as the circumstances and extent of his experiment shall reasonably demand, and as convenient to railroad facilities as possible.

Bearing in mind that the trouble does not wholly lie in the fact that now the Western beef is frozen and necessarily undergoes great changes when exposed to air and heat, but that the cattle slaughtered in the West are not in the best condition when slaughtered, our pioneer in this enterprise, after procuring his pasture, will make his provision for winter feeding and shelter, so that he may be able to supply his customers through the entire year.

If he proposes to raise as much fodder as possible on his own land, he will consider the wisdom of procuring working cattle as he may need for the purpose of working the soil and increasing its productiveness, and producing the largest quantity of the most desirable and profitable fodder, with a view always of increasing the number of acres of improved pasturage, and eventually turning his working cattle into beef.

Undoubtedly he would find it wise and profitable to clear up, drain and convert the wet intervales into what would prove his best and most permanent hay-producing acres. He would cut and burn as much brush as possible and work in grass seed, seeking at all times and in all ways to produce more acres for pasturage and fodder.

Questions of irrigation, judicious *storage* of water for times of need, and for *power* if that is needed, manures and fertilizers, must all be studied and determined upon. He must judiciously locate, build and equip his slaughter-houses with reference to saving of time and expense, cleanliness of the beef to be marketed and all its surroundings, and the quickest and most profitable method of removing and disposing of all offal.

He must search out and adopt all the known latest improvements which will make his business most successful; and further, he must invoke to his aid science and inventive skill to overcome any obstacles which mark the difference between the easy and almost laborless business of cattle-raising on the plains, and the hard work and close calculation which are the only insurers of progress and profit in most of our Eastern enterprises.

In the West, cattle-raising has been almost a spontaneity. Here not a domestic animal can survive the changes of a single year without constant watching and care.

Were I to engage in this cattle-fattening industry, I should most assuredly attempt to satisfy myself whether or not, while I aimed at the production of the best beef, I could not attach as profitable auxiliaries the raising of fowls, sheep and swine. If they could be made profitable as adjuncts, I should be pleased to inform my customers that I could furnish beef, fowls, eggs, mutton and pork, all home fattened.

There is one thing which I have almost admitted to be impossible, viz., the profitable *raising* of cattle in New England.

This admission was made partly to give the fullest force to the assumption of the author whom I have quoted, and partly because I should not have been invited here to discuss such a theme.

Nevertheless, when the prospective industry shall have found a sure basis, I predict that the third section of the fifty-eighth chapter of the Public Statutes will die the death of "innocuous desuetude," and there will be no longer Commissioners armed with authority to search the crannies of our purveyors for calves which died before they were four weeks old.

You can tell me how much a yearling calf costs, and the approximate expense of adding one or two years more to his life.

I have been amused by the attempt of a self-styled practical farmer to figure the expense he has been put to to raise a very respectable yearling, — to learn how quickly the puny thing was weaned, and put to grass from early June to the last of November or the first of December, and what quantities of meadow hay he consumed from this till the middle of the next May or earlier, and what a hearty yearling he was.

Let my friend, the beef fattener, take the calves from our dairy farms at nominal cost, and try his feed and fodder and shelter upon them, and foot up the gain or loss of the experiment. There may be odds and ends which the young stock may thrive upon.

Have I mapped out too stupendous an undertaking? Does its comprehensiveness condemn it? Do not misunderstand the scope of the proposition and you will not be appalled in the least.

I am not inviting you to furnish beef on one five hundred acre farm for all New England and New York City added.

In your speculations on the probabilities of success in this work, do not base your estimates on some barren and sandy farm or township with which you are familiar. Go to the richer grass-growing regions, well watered, capable of being transformed into rich pastures by the same means which you adopt on your own farms, many of which might easily be made to produce double the amount of feed they now produce, if grazing were made a business, and larger areas were brought into a more homogeneous condition; or, in other words, if over the entire pastures there is no choice of feed. For you must have observed that in a pasture of say one hundred acres, cattle will select the best portions and leave the inferior parts untouched; while, if the inferior parts were fenced off and cattle confined there, they will feed the ground over and thrive.

The beef-eaters of New England cities are in this confined condition, living on inferior feed; but we shall, sooner or later, jump the fence, as your cattle always do when they find out the imposition practised on them.

Let ten or twenty men with capital or experience, or both, procure as many acres as the magnitude of their proposed work shall demand, ascertain what hotels or what markets they can supply, and enter upon the work of providing the best of beef to their customers.

No farmer ever need advertise a pair of fat oxen for sale in Massachusetts, or in any other parts of New England where I have been.

If one pair is sought after on account of superior quality, five hundred head or five thousand head of like quality would also be sought after in preference to the beef now being shipped from the far West.

It is capital, brains and energy which will establish this enterprise on a footing which will eventually meet and settle the difficulty to which I have referred.

There will be no clashing of interests West and East. Both will see the wisdom of harmonious co-operation to compass the desideratum.

In our day of great enterprises, massed capital and an almost unchecked ambition, it is common to say that what can be made profitable by corporations is the ruin of the individual. We have not heard yet, however, that what private enterprise has made profitable will languish under the direction and management of capital, brains and energy.

I do not recommend any step in the direction of forming strong and monopolistic corporations, but that our farming and agricultural interests shall combine in the interest of the people.

The ten or twenty men I name I would have all, each and every one, good, honest, hard-working men, not greedy of wealth, but willing to work for the needs of humanity, and be satisfied with a reasonable reward for their labor.

I have, in this paper, given you the benefit of information I have gained upon the subject which I believe is of great importance to our people, and especially to those engaged in agricultural pursuits.

If questions of the dairy, cereals, fruits, etc , command your serious attention, engage your thoughts and inspire an ambition to excel, I am sure that this great question of good beef must demand, at least, a passing investigation, when we consider how large a place beef fills in the *menu* of our climate.

My suggestions of methods I do not insist upon. They are only such as have occurred to me in my own reflections on this, *to me*, important subject.

If I have succeeded in attracting attention to a demand for something better, I have accomplished as much as I could expect. One consideration I ask at your hands: if I am addressing those who eat only beef of your own fattening, I must ask that you put yourselves in the place of many thousands of our citizens who almost never taste such food.

Let me say, in conclusion, that I believe this industry will thrive, and perhaps can be most advantageously instituted by the efforts of individual farmers.

At least in their hands the experiment may be made under the varied circumstances of each one, and in a diversity of ways such as may accord with the views of each.

As in other experiments, so in this, some may succeed by the better choice of means, while others fail.

While I suggest experiments made on an extended scale, thinking that perhaps more capital would be required for a *successful* experiment than any single farmer could command, yet I would not discourage private trials, which have already been so satisfactory.

The Chairman. The evidently close attention with which you have listened to this suggestive and valuable paper proves to me that you are all interested in this important question, and discussion is now in order. I feel that we have a speaker who is competent to answer all your questions.

Mr. Arthur A. Smith of Colraine. I have only one suggestion to make to the gentleman who has read the very interesting essay, and that is, that when capitalists get ready to buy pasture I have a large amount, up in Franklin County, which I would like to sell at five dollars an acre. It is very good sheep pasture; and I know of a great many others who would like to dispose of their pasture-lands at the same rate. What he said in his essay in regard to the farms which might be obtained at a very low price, even in Massachusetts, is true. I am well aware, as many present are, that this matter of the consumption of beef is attracting the attention of the people throughout this State, and there is a demand which is constantly increasing in all the great cities of the land for better beef. I think that this paper has mapped out for enterprising capitalists a plan which they can with profit adopt; and while to some extent it may not be entirely practical, yet I believe that it has points of practical application, and that the beef-producing people of this State are the ones who are going to make the money, — not only the producers of beef, but of mutton. But in order to do it I do not think it is essential or necessary that we should co-operate with the West in the growing of young stock for beef. I believe that we can enter into that just as well, and raise stock here upon these hill sides and these sheep ranges, on a small scale, as we can in co-operation with them. I think this is a subject which the Board might with advantage have considered earlier, and that this matter of beef production is one which should be discussed largely at this meeting. I think it is most pertinent to the occasion, and should receive the attention, not only of the Board, but of the citizens of this interior part of the Commonwealth that is so well adapted to profit by it.

The Chairman. I think the butchers ought to know something about this matter. There is a gentleman here that I think can give you some information upon it. I refer to Mr. Burgess of Nantucket.

Mr. Burgess. It is my experience of raising beef that it is a very difficult thing to do in this section of the country, for the reason that we cannot raise enough corn to make it. I suppose, of all the cattle that go to Watertown there are ninety-nine that are not fit to slaughter. I presume that the larger part of the cattle that go to Watertown market come from over the Canada line, and the majority of them are grown well enough, but are not well finished off. You go into Boston market or Clinton market, where car-loads of fresh beef come every day, and you find it in the same condition. You find eight or ten cattle in a car that are fit to put into market. They put about thirty-five head in a car, and, on the average, you will not find more than the number I have stated that anybody would want to take to retail; and that is the story from one year's end to another. But I must say that although our market away down on Nantucket is a small market, we have had some people there, for the last hundred years or more, who have known what good beef is, and they must have it; they are ready to pay a good price for it; but the trouble is to get it. But I do not believe that you can raise cattle in this section of the country, put them into the market and get the largest price for them, unless you can devise some method of producing corn to feed them. We hear some reports that corn can be raised at a low price. I read last night an account of a man who had raised 130 bushels of corn to the acre, at fourteen cents a bushel, if I am not mistaken. I do not want to get away from the subject, but let me say a word about that. What would it cost to husk 260 baskets of corn, to say nothing about raising it? I do not believe there is a man on the face of the globe who can raise corn for fourteen cents a bushel and have his land left in anything like the condition in which it was when he planted it. There is plenty of poor beef brought to market, and as much of it comes from this part of the country as any place I know of.

Mr. J. D. Porter of Hatfield. This question of fattening beef is a subject in which I have been interested ever since I was a boy ten years old. Perhaps I cannot enlighten any of these people here upon it, because I have been doing it on a small scale. Many of you remember that twenty-five, thirty, forty or fifty years ago the Connecticut River beef commanded a good price in the Boston and Watertown markets. Fattening cattle was followed for years and years. Our farmers would go out and search the hill towns, buy the best oxen they could find in the fall, feed them through the winter, and in the spring they would be driven to the Boston or Watertown market; but since Western beef has come on here in such large quantities, that, of course, has interfered with our profits,— the Western people can raise it so much cheaper. But after all, I think that was a very good product for our farmers. We could turn what we raised on our farms into beef and get good pay for it, and get the proceeds of our crops back on our farms for manuring; but, as I said, that system died out until within a few years, when it has started up again. I have a car-load of cattle that were bought at Watertown, in my barn now. I shall feed them through the winter, and then they will go back again. Some of my neighbors are doing the same thing; some seven or eight car-loads have been brought to our town that will be fed this winter. I think, when they go back next spring they will return a good profit.

The CHAIRMAN. There is a gentleman present who is largely interested in the production of beef, and we should be glad to hear from him. I refer to Mr. Cragin, President of the Worcester North Society.

Mr. CRAGIN. I am very well aware that we, as a people, have given up almost entirely the home production of beef; and still I remember that, in some one's essay, reference was made to one old farmer who, at the time of making his will, exhibited quite an amount of property, which his neighbors were very much surprised at. They asked him how he had managed to accumulate so much property. His answer was that he could not tell, unless it had been by raising cattle, fattening them and selling them for less than cost. I believe it is true that land can be bought cheaper in Massachusetts to-day, for the purpose that has been set forth, than good lands can be bought for in the West. We are very well aware that the West is fast becoming filled up with farmers, who are taking up every acre of land that is available; and for the past three years I have my doubts whether the raising of cattle on the prairies of the West has been a success. The remark was made by the essayist, I think, that cattle three years old could be raised in the West for fifteen dollars. The past year cattle of that age could be purchased for fifteen dollars, perhaps, but it was from the difficulties arising in the Indian Territory. Large ranchmen and small ranchmen were obliged to leave because they were unable to find pasturage for their cattle; and therefore they were compelled to sell them for whatever they could get. Vast numbers of those cattle have been forced upon the market at lower prices than yearlings could be purchased for formerly. Texas yearlings have usually brought from fifteen to twenty dollars, and, as the essayist told us, the price on the ranches has been from forty to fifty dollars a head for three and four year olds.

In regard to refrigerated beef, I was not aware that it was of necessity in a frozen condition, as the essayist says. I stepped into a car from Chicago the other day at our station, and handsomer beef I surely never saw. It was not frozen, but it had been kept at a temperature just sufficient to keep it fresh. I had the impression that our butchers (I know it is the talk in the Boston market) thought that beef should be thoroughly ripened before it was eaten; that it assumes a character which is desirable by having been killed some little time. I certainly never ate nicer beef than I have eaten in the mountains of California that had hung in the open air a month. The outside of it was perfectly black and in places somewhat mouldy, but it was as sweet, as juicy, and as tender as any beef I ever tasted. Whether the refrigerator can succeed in keeping beef in that condition I am not certain. We are in the habit on the ranches at the present time, where it is possible, of getting corn to feed our cattle. This is something new, however. It is a demand of the people, and is to be complied with, and we feed our cattle on corn for a short time before they are shipped. They are driven, I suppose, from fifty to a hundred miles to reach carriage; and there are very few that go into the Chicago market, or any of those markets, that are not shipped from a distance; and I suppose there is no doubt of the fact that the irritation and weariness which are induced by a long car ride must produce fever. It has often been remarked that a horse shipped from the West in a car to any part of the country, almost, is unfit for service for eight or ten days afterwards. I believe it pays to ship cattle so that they will avoid that condition. I have not had any experience in the matter, however. Still, I have often heard it remarked.

The matter of raising corn, in connection with the question of putting our beef in competitiȯn with that of the West, is a subject to be thought of, and decided in the future. I believe we can raise beef and put it into the market, as good beef as any talked of here, as good beef as can be produced at the West, with cheap corn; and on examining the Western papers I often see the remark made that the best way for farmers to get their corn to market is to let the hog or the ox carry it. I suppose it is true, also, here. If corn here is worth fifty cents a bushel, against twelve and a half or fifteen cents there, we have that to contend with; and if hay here is worth twenty dollars a ton in comparison with from five to six dollars on the prairies, that is also an element which enters into the consideration of this question. It is a fact that to-day we are obliged to lay in hay for our ranch cattle. Last year, upon our own ranch, we got in some thousand tons of hay. All it cost us was simply the expense of cutting; but many of our neighbors were obliged to purchase at six dollars a ton. Those who would not, lost their cattle; and thousands of cattle men to-day are bankrupt who a year ago thought themselves perhaps worth their hundreds of thousands. The difficulty of gathering fodder for those cattle in the winter season increases. I believe we can raise as good beef here as can be raised anywhere.

Recess until 2 o'clock.

AFTERNOON SESSION.

The meeting was called to order at 2 o'clock; Mr. Goddard in the chair. The subject under discussion at the adjournment of the forenoon session was resumed, and the Chairman called upon Mr. E. F. Bowditch of Framingham.

Mr. BOWDITCH. I should be very glad to respond to the call of the Chariman, if I had anything to say upon the subject of fattening cattle, but I have not, never having done it.

I wish to express my thanks to Mr. Titus for the paper which he has read. It has given me a great many ideas. I agree with a great deal that he has put into his most interesting paper, and I think the business of fattening cattle could be put into practical shape, if the right men took hold of it, with very little trouble.

The CHAIRMAN. I have an impression that Mr. Wheeler of Great Barrington can give us something interesting in regard to this subject.

Mr. WHEELER. I would like to say I was very much interested in the paper that was read this morning; and while some features of it do not seem to me to be at all practicable, — for instance, the co-operative idea, — still, I think that the matter of producing beef here in New England is a practicable matter, and one that may be profitably entered into, perhaps, in a small way, by the farmers of the grazing region of Massachusetts. It is no doubt a well-established fact that our agriculture is largely connected with dairying, and I believe that in the near future the dairying interests will be carried on mainly under the co-operative method; but of course there will be sections where there will be individual farmers who cannot avail themselves of these advantages, and I think under those circumstances they may well turn their attention to cattle-raising for beef purposes.

Now, in regard to raising our beef animals here, I do not know why it cannot be done. We know very well that we can raise our milch cows very much better than we can buy them. That is practicable, and that is done to a very large extent by dairymen. Certainly in the western part of the State we find that we can raise our cows cheaper than we can buy the same quality of animals. I do not know why we cannot just as well raise steers for making beef as raise our heifers for cows.

The matter which was broached in one of the other papers in regard to making beef from milch cows after their time of service as milch cows has passed, I do not take very much stock in. I do not think we ever get very good beef from old milch cows that have done service as dairy cows. Of course they have a value, but it is small. I think our best beef is to be made from young animals, not to exceed three years old. I know in my early life there was a good deal of beef-making in our section of the State. There was a great deal of beef fattened in Berkshire County and driven to the New York market; and there is to-day considerable very good beef made in my own and some of the adjoining towns, that goes to the New York market, and is sold at remunerative prices. That is made, however, from the best of beef stock, — steers three, four and five years old. There is a great deal of land in Berkshire County, and I believe a good deal in Worcester County, that has been good pasture land, — it has been described somewhat here to-day,— farms that have been abandoned, given over to weeds and brush. There are hundreds of acres in the hill towns of Berkshire County that can be bought for a very small sum, indeed, per acre, that have, within my recollection, been very productive lands. I do not know whether they can be brought up to their former state of fertility at a profit or not, but I do not know why they should not be. I apprehend that their loss of fertility has grown out of the fact that they were fed years and years as pasture fields for dairy cattle. Sandisfield, New Marlborough, Otis, and those hill towns of Berkshire, fifty years ago, were all dairy towns. They made large quantities of cheese and butter, they raised their cattle, and the products of the farm were taken off in that way and not returned, and my impression is that the fields became exhausted as pasture fields, and will need to be renewed by restoring their fertility by some kind of fertilizer. I do not know, as I say, that it can be profitably done, but I think it may be, and I think in those sections particularly the making of beef, even from our native and home-grown stock, may be made a profitable enterprise.

The CHAIRMAN. Shall we hear from Mr. Parsons of Northampton?

Mr. PARSONS. I am surprised to be called upon to speak before this audience, for I certainly could not expect to instruct them in regard to raising beef. But as this is something in my line, I can give my experience and what I am doing in it. We live on the Connecticut River, and raise corn and hay principally, and our lands, of course, have been run so long that we have to take the manure back on to them; and as I raise perhaps a thousand bushels of corn, and cut sometimes a hundred tons of hay, more or less, I must do something with it to get the manure back again. Our way is, in the fall of the year, to buy perhaps twenty-five or thirty head of two and three year old steers, feed them with corn-stalks and the coarser qualities of hay through the winter, and in the spring turn them out to pasture on the hills some ten miles west of our place for the season, and turn them for beef, about the first of November; then go to Albany or into the country somewhere and pick up another lot of cattle, take them home, and go through the same process another year. In that way we feed out our corn-stalks and coarser feed, and take the manure back on to the land. We may feed in the winter one stable of these steers, seven or eight, and turn them in the spring for beef. I hear some men ask, What do you do with your corn? We feed it to horses. As we live close by the village, we keep horses, and do a good deal of team work in one way and another. As to going into this thing as the paper this forenoon suggested, I think we should prefer to "go it alone;" I think that we should do about as well as anybody. I do not know about this co-operative plan, or how it would work. Take my case. We can hire pasture land for our stock, with a wall around it, for $50 for the season. That is not a very dear rate for pasture. If we have fair luck with those steers from one year's end to another, they will give us $25, $35, and $50 apiece, as the market may be.

Mr. BURGESS. I would like to say a few words more in regard to this question. Our practice on our farm is to buy oxen that are well broke, at about four years old, calculating that they will pay their way until they are five or six years old. We keep enough of them so that every year we can take out one or two pairs. I have five pairs now. I believe that in some directions in farming we should go back instead of going ahead. I am entirely ignorant of the surroundings of this territority, but I presume that there are a great many farmers who are doing all their work with horses; and it is one of the things that I think altogether wrong. I do not believe that any farmer, no matter where he is, or what he is doing, can afford to farm it in any other way than by oxen. In the first place, the wear and tear is nothing to what it is with horses.

Question. How do you do your mowing?

Mr. Burgess. Do your mowing with horses, if you please. If you are on a small farm, where you are cutting only eight or ten tons of hay, that is another thing. But I presume there are farmers in this section who are keeping two or three horses to do their work, where one horse would do all the work that is necessary. Have one horse to do all the horse labor that is necessary on the farm, and oxen to do the rest of it. The most thrifty farmer we have in our town is an ox man, and every once in two or three years, or oftener, he takes off his oxen and has some steers to take their places. Seven years is as good an age as any to take them off. We give them plenty of hay and four quarts of meal a day. A farmer who cuts 100 tons of hay cannot afford to be without a pair of oxen, in my opinion. Of course, I know that you will not all agree with that; but I can draw hay cheaper with oxen than I can with horses. I can harness them cheaper, and the wear and tear is a great deal less. There is no time when you can feed an animal so cheaply and profitably with meal as you can when he is on grass. You may not think so, but I know it is a fact that he will put on two pounds with meal easier than he will put on one without it. With corn at 60 cents a bushel and hay at $20 a ton there is no feed so cheap as meal.

Mr. West. I think if we are to follow the suggestion of the essayist, we should make somewhat of a specialty of breeding. That is, if we live near a city, there are people enough in the cities who are always willing to pay extra for their beef, as there are some who are willing to pay eighty cents a pound for their butter. The gentleman last up says he believes in keeping oxen. This is considered rather a slow team up in our section. We have two or three pairs, and keep them ; but I should not advise a man to keep oxen to do all his farm work, because the condition of things has changed from what it was twenty or thirty years ago. We have got our mowing machines, and we must have horses. If a man can get twenty-five or thirty cents a pound for his butter, there is an assured income ; if he can get a higher price, so much the better. If a man can get a dollar a pound for lambs dressed, such a man wants to raise lambs, if he can. There are such men. Of course if they can get fifteen cents a pound for their beef, as some of them do for their pork, where they have an extra thing, or make people think it is extra, then they can feed beef ; but as to trying to do it on these hills here, or by any co-operative plan, I have my doubts about it. But I do not like to see these milk cans standing by the depot, three or four miles away ; I don't believe the milk raisers get over three cents a quart for their milk. They had better turn their attention to making butter, and get thirty-five, forty or eighty cents a pound for it, if they can. That is a better way, in my opinion.

Mr. Smith, of Colerain. There was one remark in the essay which I think needs a little explanation, which I forgot to make before dinner. The essayist made the statement that there was a butcher in Worcester who came up into this part of the county and bought as many fat oxen as he could ; and if he could find a sufficient quantity, he would supply his market with that kind, rather than to use Western or refrigerator beef. Now, Worcester County people are not a peculiar people, and I do not believe but what they are as selfish as they are in other counties, — particularly butchers. I understand they come up here, and they base the price they offer for this well-fattened, grass-fed or meal-fed beef upon the price for which they can procure the refrigerator beef, and they buy it at that price, or they will not buy it at all. What encouragement is there for the farmer to raise it, admitting that it is much superior? The butchers buy it as low as they can in competition with Western beef, and they sell it to the consumer for three or four or five cents a pound extra as home-grown beef. Where does the profit go? Not into the pocket of the producer or the consumer, but to those butchers in Worcester who want to do so much for the farmer. So it is with the lambs that are raised by the Honorable Secretary of the Board of Agriculture and others. These are the butchers we have got to deal with, and we must arrange it in some way so that the consumer of this extra quality of beef and the men who grow it shall receive the benefit, in part. I believe in a co-operative plan that will bring about this result. If we can bring the producer and the consumer of milk, butter and beef nearer together, it will be a mutual benefit; and if the essayist or any other man in the country can devise any feasible project for bringing that about, he will be a public benefactor.

Mr. Titus. I think the secret lies here: There is so small an amount of beef fattened in the neighborhood of Worcester, it is very likely any sharp butcher or dealer in beef will go to these farmers and say, "I want beef;" and he will drive a sharp bargain, getting the beef on the standard of the Western beef price. That is no weakness of the project that I have in view. It is merely the result of facts as they exist at the present time. My project is to have the time come, and come as soon as it may, when there will be a sufficient quantity — or as near a sufficient quantity as possible — of beef fattened in our own neighborhood to supply the local market; and then what will be the result? In all human probability, if we are to judge this business by other kinds of business, the New England fattened beef will have its price, and I hope it will not be any higher than it is now, unless it is necessary to remunerate the producer of the beef; but if it is a satisfactory quality of beef, it will not necessarily be three or four cents a pound higher than good beef is now, but it will command a price in the market which will force down the price of the inferior quality. I believe that is common sense. I believe that is the way human affairs are generally conducted. Mr. Taft suggests to me that I give the name of the butcher to whom I referred. I have no hesitation in giving his name: it is

Mr. Morse, of the firm of Morse & Mansfield. Mr. Taft says he pays two or three cents a pound more for this beef than for Western beef. I do not see how he can get it in any other way, for I have seen cattle driven through the town by himself that were immensely fat; and I have seen men follow him (I have done it myself), and ask him what he was going to do with that beef, — if he was going to have it in his stall for sale. That beef does command a better price; he gives a superior price for it and he gets a superior price. Still, he cannot get the number of cattle of this kind that he wants in his business, and he has to rely somewhat upon Western cattle; but he has very choice and select beef, and gets better prices than many others do. I do not know of any other remedy for the difficulty that the gentleman has suggested but to raise a sufficient number of fat cattle to supply our markets.

Mr. Hutchins of Sutton. When I was a lad I did not have to go a great ways in our town to find a pretty long string of oxen. I can remember going up to Worcester and driving a string team of fifty or sixty pairs. To-day you may go the town over and you cannot find but a very few pairs. I am in full sympathy with the gentleman who spoke in regard to oxen. I believe in oxen, and if the essay does not have any other effect than to turn our attention to the raising of cattle again, it will do some good, I believe. I should be glad to see the cattle on a thousand hills, or a thousand cattle on these hills, — if there was anything for them to eat.

There is another thing I should like to see, which I used to see in my boyhood, when I went to the village school. That was sixty or seventy pupils, all the way up like a flight of stairs, — ten or a dozen from one family. Go back and raise a few Yankee boys and girls. I want to see good New England stock raised, — boys and girls, as well as oxen. We have a few men in our town who own up to liking oxen, who raise them from calves and sell them to our friend here, when they get to be three or four years old. They make it as profitable now as they ever have. It has been suggested that most of our butter is to be made by the co-operative creamery system. The latest plan is to take the cream from the milk, and to leave the milk. You know you can raise good calves on skim-milk, with a little meal. I see no reason why we cannot go back and raise them for our own herds. As to fattening them, I see the difficulty suggested by our friend over there. These hills have been skimmed until there is nothing left on them; but we have got to get them back into fertility in some way. I do not know but putting cattle on them would get them back. But this is a great question, and some good thoughts have been thrown out here, which I hope will bear fruit.

SPECIALTIES IN FARMING.

BY AVERY P. SLADE.

All whose memory runs back twenty-five or thirty years must have noticed the wonderful changes that have accompanied the progress of New England agriculture. It was once thought that success in farming depended chiefly on muscular activity, and that the cultivation of the brain or the employment of brain-power had but little to do with the cultivation of the soil; hence the prevailing custom in those days of selecting the brightest boys in the family to adorn professional life, and reserving the thick-headed dunce, who was always at the foot of his class, for the drudgery of a farmer's life. But since science has come to the aid of the farmer, and lighted up the path of the husbandman, the old custom has been completely reversed, and now doctors, lawyers, and I may say clergymen, are made of the indifferent material, while the lad having the most sense — and that is made, in fact, of the finest clay — is the only one that can reasonably hope to become a successful farmer. Everything pertaining to the advancement of agriculture is being made the subject of careful experiment and rigid scientific investigation. The laws governing the vegetable kingdom, and hitherto unknown, are being transcribed from tables of stone, infinitely multiplied, and scattered on paper leaves broadcast from the schools of science among the tillers of the soil.

Farmers' clubs, which are scarcely outnumbered by the school-houses in the States, are discussing questions of policy and economy; while chemistry, as applied to agriculture, is becoming practically understood by many farmers in our State. The transition from old methods to new becomes more and more rapid in its progress, and he who does not recognize the fact and appropriate the lesson will fall far in the rear.

There are practical questions upon which thoughtful men do not agree, and many cultivators are yet undecided whether it is better to follow the old method of mixed farming, as it is called, and grow the full variety of crops, or shall they select, say one, two, or three at most, make these their constant study and rely wholly on them for income. In times past agricultural journals were unanimous in their advice to the farmer to produce everything on the farm which might be consumed in a farmer's family, and he who neglected to do this was regarded as a man who, having a talent, wrapped it in a napkin, and buried it in the ground. I well remember a farmer who was sharply criticised for having purchased a stock of cabbages for winter use, when at the same time it was admitted that he paid less than one-half what they would have cost had he raised them himself. The question which then very naturally suggested itself was, Why should not the farmer, like the merchant, buy in the cheapest market and sell in the dearest? Farmers are proverbially a conservative class, and are inclined to follow in deep, well-worn ruts; but surely there is nothing in the cultivation of the soil or in farm-husbandry in general that should prevent them from taking every advantage of their circumstances, and raising such crops as will net the most money, putting fertilizers where they will do the most good, and bestowing labor where it will yield the greatest compensation. All business depends for success on shrewd management, keen foresight and undivided attention. A man cultivating a great variety of crops on a large farm, to be successful with all, must possess good knowledge of the habits and wants of each; and this knowledge, like the manure he uses, is often made to cover too much ground, and is liable to result in a total failure, or at best a partial success. Now, while we would not wholly condemn mixed farming, or advocate a sudden change to specialties, yet we would advise young men, or new beginners, to make a choice of one or two *special crops*, and make their perfect growth and development the aim and study of a lifetime. This course, we think, would not only be productive of both pleasure and profit, but would kindle enthusiasm, so essential to the successful prosecution of any pursuit in life. A striking characteristic of the age is the division of labor, and as industries multiply the tendency is to divide and subdivide. This runs through not only every department of human industries, but in all scientific investigations it is carried to a greater extent perhaps than in the mechanic arts.

Let me relate an instance which is fresh in my mind that will go to confirm this statement. Some years ago Professor Farlow of Cambridge was invited to deliver a lecture before the Board of Agriculture at Waltham; his subject was the fungus, or mildew, which makes its appearance on the under side of the grape leaf. The subject was treated at length, showing great scientific research, and was profusely illustrated by large and costly drawings. At the close of the lecture questions were announced to be in order, and as the mildew which troubled my vines appeared on the upper side of the leaf, I ventured to inquire wherein it differed from what he described. The reply was, I know nothing whatever of the fungus you have noticed; that involves a different line of investigation, and is intrusted to a man in Paris, who informs me he will be able to make a partial report in two years. A few years ago the village doctor was supposed to be master of all the ills that flesh was heir to. Having studied medicine and received a diploma, it was taken for granted that he had acquired an exhaustive knowledge of every real or imaginary disease which afflicts humanity, and his surgery and knowledge of medicine were regarded as equal to the most critical emergency. But the medical profession has kept pace with the progress of the age. Public sentiment has decided that one man cannot know everything, and has demanded a more thorough knowledge of each disease. Hence infirmaries for the treatment of special diseases have been established and endowed in this country and in Europe. We now have a specialist for the eye, the ear, the liver, kidneys, lungs, diseases of the skin, etc. Whatever progress has been made in medical science during the last twenty years is clearly referable to a division of labor in the line of research. Though the carriage-maker is no longer a wheelwright, and the shoemaker has lost his trade, yet the result is seen in better carriages and more durable shoes; and wherever a division of labor is practised to the greatest extent, it is there we look for the choicest products of human skill. What is true in the mechanic arts is also true in agriculture. The man who makes a specialty of any given crop is very justly looked up to as possessing superior knowledge of everything pertaining to its habits, wants and growth, and the public concede to him the reputation of producing the best. Experience teaches that however glutted or depressed a market may be, superior specimens sell at remunerative prices. Specialties in farming mean better culture, larger crops and higher prices.

There is not a plant that grows or a flower that blooms in the vegetable kingdom whose perfect development may not challenge a lifetime of close study and laborious investigation; and he who has the patience to explore into the realm of nature, and make himself master of her secrets, will be rewarded with special delights and pleasures which can be drained from no other source. A knowledge of the wants, habits and tendencies of a particular plant, and the means of successfully exterminating its enemies, is obviously of more importance than a superficial acquaintance with many varieties. We can reach such knowledge only by close attention to the plants that we select for our study. We must become specialists, as those are called who devote their research in science or art to branches of their professions. Suppose, for an illustration, that the farmers of this town were compelled to rely wholly on a crop of asparagus for the money they were to receive from year to year. The beetle, whose depredations are so fatal to the perfection of this crop, would be hunted as a common enemy by an army of allied forces. His habits, his hiding-places and the means for his sure destruction would be as familiar as nursery tales, and his early appearance would cause no more alarm than the buzzing of a common house-fly or the joyful antics of a summer swallow.

The soil, culture and kind of fertilizer best adapted to the plant, and in fact everything pertaining to its perfect development, would be clearly and fully understood. Similar results might reasonably be expected by giving special attention to other crops. The larger the number of crops grown the greater the variety of tools and implements called into requisition. Many of these are used but a few days in the year; all must be repaired, stored and cared for, forming an item of labor and expense not to be overlooked. Then in regard to labor: the man or boy who is an expert at hoeing onions, thinning fruit or setting strawberry plants will do twice the work in a day and do it better than a common farm-hand who turns his hand to everything but can do nothing very well. As labor is the largest item in the cost of nearly all crops grown, it must be admitted that the specialist in this respect would have an advantage which one engaged in mixed farming could not be expected to have. The chronic objection urged against specialists is the risk of a failure: one crop is more likely to fail than all of several; it is not safe to risk all your eggs in one basket. To which we might reply that he who has *too* many irons in the fire is pretty sure to get some of them burnt. We have already asserted that the growing of special crops means better and higher culture, and where this is practised to its fullest extent the chances of failure are reduced to the minimum. Where the habits and wants of a plant have been made a special study, and those wants are fully supplied by an intelligent cultivator, success is about as sure to follow his labor as is the return of seed-time and harvest. It must be admitted also that the scarcity which follows a partial failure raises prices, and the cultivator is often reimbursed at the expense of the consumer. One should not decide hastily in the choice of crops that he will grow as specialties. Many things are to be taken into the account, all of which are important: the soil, the climate, the facilities for marketing, the amount of capital one has to work with, the character of the labor to be depended on. If a man is not settled in the business of farming, but is only looking for a gainful vocation, let him reflect that success depends mainly upon the natural or inherent liking for the occupation he is destined to pursue.

A person's taste and predilection should be carefully consulted before a final decision is made. It is said that every good man has a hobby, and this, rightfully interpreted, furnishes a key to his character. It was predicted of a six-year-old boy, who was going about with his father's vest on and a chicken in each pocket that he was treating for the roup, that he would some day distinguish himself as a poultry fancier. He is now one of the leading men in that important department of husbandry. Col. M. P. Wilder, while he was a devout lover of nature and truly grateful for all her gifts, regarded the *camilla* as the queen of flowers, and gave forty years of his life to the development of its marvellous beauties. Mr. Hunnewell chose the rhododendron. Mr. Ephraim Bull of Concord, after years of patient experiment in a field suited to his taste, and in which labor was a pleasure, was rewarded with one of the best gifts ever bestowed upon man. The fruitage of the Concord grape is not only a legacy to the present generation, but an annuity entailed on generations to come. The originator of "Moore's Early Grape," whose indomitable will is always strengthened by the obstacles it meets in his favorite pursuits, and in whose mind impediments to success are but phantoms of the air, for a score of years communed with nature so closely and so devotedly that she was compelled to yield to him the *vine* bearing her choicest clusters; and he has been crowned with a wreath like that so long and proudly worn by his illustrious neighbor. Let me not be misunderstood: I would advise no man to engage in special agricultural pursuits unless he is willing to consecrate his life to the work of improvement or development. He should not only avail himself of all existing knowledge pertaining to his business, but should eagerly and persistently seek for more. I know that it is fashionable to advise men to use their brains if they would succeed in life. This is all very well, only the advice is not given with sufficient emphasis. The brain is the motor which moves the world. "Brain is king," muscle is subject; whoever is deficient in the former will succeed better in any other business than farming. Where can be found a more imperative requisition for brain-work than in the work of eliminating the objectionable points in a herd of cattle, and replacing them with qualities in every way desirable. With a scanty stock of brain-material, how could one reasonably hope to improve the quality of vegetables, and produce new and choice varieties of fruit, and hasten or delay the time of its maturity? Let no one for a moment suppose that these achievements are the work of chance: they come to the man who loves and studies his business, who watches the growth of plant and fruit in every stage, who anticipates their every need, and who breathes on every leaf and communes with every flower. Brain, like muscle, derives its power from exercise and discipline, and this is accomplished only by close and accurate thinking; and it should be remembered that the only thinking that bears fruit is systematic thinking. Many a young man imagines himself thinking when he is only day-dreaming. Thinking implies an active state of mind; calling up images, holding them fast, and arranging them in order,—not a passive condition in which troops of ideas flit across the mental vision like figures in a kaleidoscope. Thinking, worthy of the name, is work,—systematic, calm, connected work; and the man who has not his mind so disciplined that he can thus command it, is no thinker. The power to think correctly is an accomplishment to which there is no royal road, but results from years of patient toil and practice. It is a conceded fact that mankind in general have a sort of inherent aversion to systematic thinking. Hence the doctor thinks for his patient, and the lawyer for his client, the clergyman for his parishioners, and the journalist for the public. Nature answers no impertinent questions, nor does she wink at our ignorance or pardon our mistakes. She is ever ready to respond to intelligent inquiries, and is partial to those who interview her most persistently and most frequently. I have endeavored to impress on you the paramount importance of thinking correctly, for the reason that all achievements, whether in the mechanic arts or in the domain of agriculture, in the laboratory of the chemist or in the realm of literature, result from accurate and systematic thinking. Whatever is worth doing at all is worth doing well, is a maxim written in all languages, and is as old as the race; but how seldom is this verified in practical life. If the truth of this problem admits of an exception, it need not be sought for in any department of farm husbandry.

There is not a domestic animal on the farm, nor a plant or a flower in the field, which does not delight in an interview with the husbandman, and hastens to respond to his kind and intelligent treatment. If the young man is discreet in the choice of a pursuit in life, it matters but little what that pursuit may be, providing he has an abiding determination to do for it everything that will promote its advancement. This conclusion must have forced itself upon all who have been close observers of human conduct. I know a man who commenced business with a capital consisting of a single ear of pop-corn. He still continues his business, but lives in comparative affluence. I know a man who from year to year tills a single half-acre of land; it is enclosed with a tight board-fence ten feet high. The enclosure is stocked with fowls, and he grows grapes, pears and quinces, and as near perfection as any that it has ever fallen to my lot to examine. He is a hard student, an unremitting worker, and withholds nothing from his pets which he thinks will accrue to their benefit. He realizes for his labor about $1,200 annually, and has for many years. Neither curculio, or rosebug, or frost, or drouth impairs his success. His business is a practical illustration of the lesson I have endeavored to enforce in this paper. On the specialist we must depend for the removal of every obstacle which lies in the path of agricultural progress. All true progress in agriculture, aided by science, has resulted from pursuing the course I have endeavored to outline. By such a course Mr. Edwin Hammond of Vermont came to understand so well the principles of breeding, that every desirable quality in a sheep distinguished his flock from all others. The Collins' and Bakewell's in the old country spent long and studious lives in improving their flocks, and with such marvellous success that they are justly regarded as public benefactors. We are to a great extent feeling our way in the dark; we are walking by faith, and shall continue to do so until each unsolved problem in agriculture is entrusted to the care of competent and enthusiastic investigators.

In view of the marvellous results which have rewarded the scientist during the past few years, what may we not expect in the near future? The fluid which followed the string of Franklin's kite to the earth has restored to us the age of miracles; and somewhere in the process of evolution there is a great man coming forward who will supplement these discoveries, and cause them to subserve the interest of the husbandman. He will drain the water from the clouds, and keep at bay the late and early frost. He will increase the productiveness of the soil by a simple, inexpensive process, and hasten or retard the maturity of fruits and flowers; the complete extermination of all noxious insects, the cause of so much labor and blighted hopes, shall be but a morning's pastime; and here the rays of our prophetic candle are *lost* in the dawn of a brighter day.

The CHAIRMAN. I find the following question in the Question Box: "Would not the agriculture of the country in general, and of Massachusetts in particular, be promoted by the establishment of Experiment Stations in the several States, by appropriations made by Congress?"

I will ask Mr. Ware of Marblehead to answer that question.

Mr. WARE. I suppose no person who has received the Monthly Bulletins from our Experiment Station, studied them, and profited by the lessons thereby given, would fail to answer this question in the affirmative. While we have in Massachusetts various means of education in agricultural directions; while we have the Farmers' Clubs and the Grangers for the education of the farmers' families, and the Annual Fairs of our Agricultural Societies for object lessons to be presented to our farmers, for comparing the productions of one locality with another, and thereby enabling us to improve our stock and productions; while we have the Agricultural College for the education of our young men in agricultural directions, and while the graduates are bringing to us from time to time the results of the education they obtain there in the line of agriculture, and taking a position among us as educated men,—we have also the Experiment Station of Massachusetts, for the education of farmers on the questions so continually coming up, requiring careful and thorough investition, which they are unable with their own means and ability to make; but by sending in our questions to the Experiment

Station, and having clear and explicit answers returned to us, we are enabled to profit thereby. And therefore, as I say, those of us who receive these Monthly Bulletins cannot fail to answer this question in the affirmative. This applies to Massachusetts. How is it with the different States of the country? There are some Experiment Stations located in different States, and we are enabled to compare their work with ours. They are investigating questions applicable to their localities. Now, would it not be of great value to us here in Massachusetts, as well as all over the country, if Experiment Stations could be established throughout the country, which should conduct experiments not only with special reference to the locations where they are placed, but which should consider questions belonging to the whole country, comparing the results of investigations one with another, and receiving reports from the Commissioner of Agriculture at Washington, showing the results of certain experiments that are applicable to all parts of the country? It seems to me that there can be no question that the cause of agriculture would be promoted by an appropriation from Congress, establishing Experiment Stations in different parts of the country. Some action has already been taken in that direction. We have, as I understand, already pending before Congress a bill for this purpose, appropriating $15,000 to each State where Agricultural Colleges have been established, for Experiment Stations to be established in connection with these colleges, for the purpose of conducting such experiments as have been indicated. Can there be any question that if that is done it will be of great advantage in promoting the agriculture of the whole country? While it will cost something to the Government, it seems to me that we shall receive returns tenfold; and we ought, I think, to advocate the passage of such a law. I have given a good deal of thought to this subject; I have made a special study of the work of our Experiment Station in Massachusetts; I think I have learned the value of it. I have therefore prepared certain resolutions which I would like to offer at this time, to bring about such legislation as I have indicated, or in aid of it.

Whereas, There is a bill now pending in Congress, called the "Hatch bill," which provides for the establishment of Experiment Stations, in connection with all Agricultural Colleges now or hereafter to be established by land grants from the United States;

And whereas, All Experiment Stations that are now in operation by State legislation have proved of great value to the agricultural interests of such States as have made appropriations for their maintenance; therefore,

Resolved, That the Massachusetts State Board of Agriculture approve the passage of said Hatch bill, provided that it be so amended as to invest the Board of Control or Trustees of Experiment Stations provided for by State legislation with the appropriations made by Congress; also by providing that fifteen per cent. of the appropriations made by the Congress of the United States for the support of such Experiment Stations shall be expended, if needed, in conducting such experiments as the United States Commissioner of Agriculture may direct.

Resolved, That we do urge the United States Senators and Representatives of Massachusetts to exert their best efforts to secure the passage of said Hatch bill, with the amendments as above.

Resolved, That our Secretary be and is hereby directed to serve a copy of these Resolutions upon each United States Senator and Representative from Massachusetts.

Mr. Chairman, I move the adoption of these resolutions.

Professor GOESSMANN. The Hatch bill was discussed a year ago at Washington by the delegates of the Experiment Stations and Agricultural Colleges, and was endorsed, with some amendments. There are some objections to that bill which it would be well to remove. I will point out one or two. The bill provides that the Commissioner of Agriculture shall fix the price of fertilizing materials throughout the country. It is impossible to give satisfaction in that way; each locality has its own price, and the local price can be better determined in each particular locality than at Washington. There are different prices in the Southern States and the Western States from the Eastern States, and to allow the Commissioner to fix the price, in my opinion, would not be desirable. It would be better to leave it to the local authorities. Here in New England the prices in the markets of New York, Boston and Philadelphia might be compared, and then the price fixed and communicated to the farmers of this section. The price of slaughter-house fertilizers in the Western States is cheaper than here, and the price of phosphates at the South cheaper than with us; and therefore regulations of that kind would not meet the requirements of different sections of the country. This point was mentioned as an objection to that bill. Another point mentioned at that time was that it was not advisable to charge the Commissioner with the control and management of the different stations in the several States, but simply assign him the duty of compiling the statistics of the different stations, and then distributing such information as might be found of interest to the country at large.

The question was then put, and the resolutions offered by Mr. Ware adopted.

QUESTION. What kind of horses should farmers in this section raise?

The CHAIRMAN. Will Mr. Bowditch answer that question?

Mr. BOWDITCH. I am a very one-sided person to ask, because every one knows I have been very much interested for the last few years in Percherons, and their grades. I do not know of any work that a horse can do that a grade Percheron cannot do better than any breed that I know of. Of course, if you go for speed, that is another matter; but if we take the wants of the farmer for a starting-point, a Percheron horse got from a good-sized mare can be broken at two years old and will do the lighter kinds of farm work. They are very tractable and docile, and will certainly pay for their keep at that age, and can be sold at three years old for a four-year-old animal. If the horse has any style and action, as most of them have, he will sell for almost a fancy price. If it so happens that he merely has size without any great action, he has weight enough to make him useful as a draught horse, and will always bring a great deal more than he has cost to raise. At the present price of horses, a horse that will weigh from eleven to twelve hundred pounds, as most grade Percherons will at four years old, is worth in the open market at least $175, and probably over $200. As far as I have seen them and watched them for the last six or seven years, the majority of them are handsome, stylish horses, that are capable of travelling and do travel easily eight or nine miles an hour; and such horses are always sought for as family horses. Their temper is almost invariably good. The old Society imported a few years ago a few stallions. I am sorry to say that there are not as many colts scattered through the State as I wish there were. One has been brought back to this neighborhood, and my advice to all farmers who can do so is that they raise a few colts. I have had three or four grade Percherons in the last five or six years, and there is nothing that they have been called upon to do, whether in pleasure driving, under the saddle, or in farm work, that they have not done in the most satisfactory and cheerful way, without a day's sickness or a day's lameness.

Mr. Brooks of West Springfield. I can fully endorse what Mr. Bowditch has said about horses. I suppose there was never a breed of horses in this country that was worth any more than the Morgan horse. He had style, he was fast, and he would hold his own. A Morgan horse at twenty years old was younger than some other horses at twelve or fifteen. He was worth more really at that age, because it is a characteristic of that breed of horses to hold their own into years. But in those days when we thought so much of the Morgan we were working oxen. There has been a good deal said to-day about the value of ox teams. It is all very good, and I used to delight in driving an ox team; but in these days we have to do a great deal of work with a team, and do it in hot weather: that is what causes us to give up our oxen. They can do a great deal in cool weather, but oxen cannot do the work that we require to have done in hot weather; it will wilt them, and we cannot afford to pay men the wages that we have to pay now to stand and wait for an ox team to cool off. They cannot work in our machinery to advantage. For these reasons we require heavier horses to take the place of oxen than we wanted thirty years ago; and what the farmer wants to-day is a horse that can do his heavy work, and when that is done, that can skip off to town. As far as I have observed the different breeds of horses, there is nothing like the Percheron for that work. I may be a little prejudiced, for after a good deal of effort I succeeded in getting one of the horses imported by the old Society, and our people appreciate him. He has style and action. There is not a double team in Massachusetts from which, if you wanted to take out one of the horses and put in another, I would not agree to take that Percheron stallion and put him in by the side of any horse in the State, and go right along and do a day's work with him. As to his speed, I will say that I met a gentleman in Springfield last summer, and he said to me, "That horse of yours is a pretty good traveller." I said "Yes; it is rather a surprise to us, for we did not expect much in that line from so heavy a horse." "Well," said he, "you had him on the road to Holyoke the other day and I was behind you; I thought I had a pretty good horse, but I couldn't keep up, although I tried." I did not know he was on the road, and did not know he was trying.

The colts of this stallion are splendid stock, and they are growing in favor. He is a large horse, 14½ or 15 hands,—something, in comparison with other horses, like the Holstein cows that have been spoken of here in comparison with other cows. He makes good use of all the food we are giving him. We keep him in a box stall, and neither myself nor any of the men on the farm ever hesitate to go into that tight box stall, if necessary, with a currycomb and brush and clean him; and if we take him out, we never think of having any trouble with him any more than with our old dog. Of course we understand that it is our business to be masters, and we never have any trouble with him.

Secretary Russell. I can say, gentlemen, that I agree entirely with the men who have spoken. I used to be an advocate of horse-breeding, but now I do not believe that to the average farmer there is any money in raising colts. I say "the average farmer," because that is the common expression. Whenever we are discussing any other topic, we speak of what would do for "the average farmer." Mr. Brooks is a horse man. He understands horses; they know him, and he handles them easily. He can raise colts and make money on them. So can his neighbors about him, for they will do it pretty much under his direction. The same thing is true of Mr. Bowditch. I have done pretty well with colts myself, but I cannot say that I, as Secretary of the State Board of Agriculture, have ever advised the Massachusetts farmers to raise colts for profit. There is a good deal of pleasure in raising a horse or two on your farm, where you enjoy the society and company of horses, handling them and training them; but when you can buy a good horse, four years old, and have your choice out of two or three car-loads of them, grade Percherons for from $175 to $225, I do not think it pays the person of whom we always speak as "the average farmer" to raise them for himself. It is a trade to raise horses. It requires all the thought that Mr. Slade has spoken about so feelingly this afternoon as being the basis of success in farming. I have laid awake nights and wished that some of my colts would die. (Laughter.) I did not want to kill them, but I should have felt relieved in my mind if they had disappeared from the face of the earth, so that I would have no more trouble with them.

We in Massachusetts have long and tedious winters, and it is a very difficult question to know what to do with colts coming a year old and before they are two years old in the winter on the farm. That was always my trouble, — how to grow up a colt in the winter without fattening him. You do not want to fat a horse any more than you want to fat a hired man (laughter and applause); but they generally get fat after you hire them. You want to grow a young horse and make him muscular and powerful and develop him to the fullest extent, and the great difficulty that I found in raising my colts was to give them exercise in the winter. If you turn them out to exercise themselves, you run very great risk. They are very apt to injure themselves by running in the cold, sharp air that stimulates them very highly, or slipping upon ice and going against a fence in that way, and making blemishes upon them that are serious defects upon a horse, and always take off a great deal from his value if you want to sell him.

The Percheron horses I think as highly of as either of the gentlemen who have spoken about them. As compared with Morgan horses, they have the advantage of size over the Morgans, but otherwise they resemble the Morgan horses of thirty or forty years ago very closely indeed. They are the old-fashioned Vermont Morgan horse in form, only, we will say, two sizes larger. They have that same remarkable domesticity that was such a marked feature of the Morgan horse. It is one of my particular hobbies that the Morgan horse, descended from the single horse, Justin Morgan, that took his start in West Springfield about half a century before Mr. Brooks started there, was descended from that Arabian horse that was kept in Connecticut prior to the Revolutionary war, and was bought by General Lee of the Provincial Army, under the direction of General Washington, and was taken from Connecticut to Virginia, where his blood became mingled in the pedigrees of several of our thoroughbred lines. That Arab left his blood there in the valley around West Springfield, and in my opinion the quality and character of the Morgan horses must have been taken from that strong line of Arab blood there in the Connecticut valley, and it lasted almost a century. It is all gone now. When people talk about a Morgan horse to-day, they are talking about something that cannot possibly exist. There is no more a Morgan to-day than there is an original Smith (laughter); the name and blood have been crossed with all other families, so that the blood itself has been infinitesimally subdivided, and they are just like other people; and so the Morgan horses are just like any other horses, with no special Morgan about them.

The Percheron horse has been bred in France by constant infusions of the Eastern blood, — the Arab. He has the fine mental qualities that have distinguished the Arab horses in all ages. This domesticity, docility and adaptability to all the purposes of man that the Percheron shows in such a marked degree, he holds in common with the Morgan horses, that were the pride of the New England people when I was a boy. There is one trouble about breeding Percheron grade horses for sale. They are almost invariably gray, and when any man tells you that they will be of any other color, he is predicting what is very unlikely. In the last century it was necessary to have gray horses. You will ask why it was necessary to have gray horses. It was because all the continent of Europe was travelled by post horses; men travelled by night in post chaises, and the horses were ridden by postilions, and the traveller in the night, sitting back in his coach, riding long journeys over rough roads, liked to see a lively team in front of him (I mean in color) in the dark. He could see whether the postilion had gone to sleep and tumbled off of a gray horse better than he could with a horse of any other color, and it was the object of men breeding for posting purposes to get as many gray horses as they could. Consequently grays were the ones that were kept to breed from, and so entirely has that color become part of the Percheron horses, that you may say that it is a rare exception when you see one of them that is not gray. Where they are not gray they are liable to be black. And let me say to you that black and gray are almost interchangeable colors in a horse. Gray colts, as you all know, are foaled black, and they become gray very easily after they get to be a year old.

In regard to the use of oxen as compared with horses on our farms, I sympathize entirely in feeling with the gentleman from Nantucket, and with my good friend from Sutton, about the use of oxen. There is nothing I love so much as to see some other man using oxen. (Laughter.) I rejoice in them; I love them. There is something beautiful about the work of the ox upon the farm; but where farmers have got to use machinery to the extent that they must in our time to keep up, and where there is so much going to market and so little drawing of wood and heavy products off of the farm, I think that we are compelled now to use horses and to give up oxen, as a matter of economy. Of course I am leaving out the question that was so ably presented here this morning, the raising of beef on the farm. I mean, that for the work of the farm we must, I think, rely upon horses; and the Percherons certainly under those circumstances are the horses best adapted to the farm work, for they are not only large and powerful, but docile and willing to do any work that they are called upon to do, heavy or light, and they have a remarkable turn of speed. Some of the handsomest horses ever seen in the world are in the coupés of the city of Paris, — selected Percheron horses. There are really three sizes of those horses, and if I criticised at all the horses imported for the Society for the Promotion of Agriculture, I should say that they were rather too heavy. They are so large, indeed, that I think people are a little averse to their use.

Possibly that is one reason they have not had greater success up to this time. The horse that is now kept in Barre was taken up into Franklin County first. It was thought that the people of Franklin County were intelligent enough to see the value of this horse and to use him. But the very contrary was the fact. (Laughter.) The horse was not treated with any degree of fairness or respect in Franklin County, and there are men here now before me who ought to blush with shame for their conduct in regard to that horse in Franklin County. I am very glad that the Society for the Promotion of Agriculture took the horse away from Franklin County and brought him into my district — I was going to say. I mean, brought him to Barre, where I hope he will be better appreciated and do the good to the people of this region that we would have been so glad to have had him do up in Franklin County.

Now, if there is anybody who wants to ask me any questions, I am ready to answer them, if I can.

Mr. CRAGIN. Is it not probable that the grades will really be smaller?

Secretary RUSSELL. The grades of the Percheron are undoubtedly smaller than the large horses that have been brought here. I have seen a number of the colts of the horses brought here by the Society, and they are very good and very handsome colts. You have an opportunity to see grade Percheron horses now in almost every lot of horses brought into the city of Boston, or into any of our cities where horses are brought from the West. The West is being filled with the Percheron stock, and it gives a promise to us in New England of a stock of valuable horses at less expense, as I say, than breeding for ourselves. There is Mr. Dunham of Wayne, Ill., who has imported something like 2,000 Percheron stallions, and they are spread all over the Western States. That is the reason why you see such fine, game horses being brought here now, three or four years old, from the West. We need have no fear now in buying Western horses of getting old ones; the thing to look out for is not to buy too young a horse. When you look into a horse's mouth now-a-days, look and see if he has got a full mouth; that is, if he is five years old. You are very liable to buy a three-year-old for a five-year-old. They used to lie one way, and now they lie the other. The object is to put them on the market and get their money for them. They are horses of very early development. And there is another thing that may be said of them, to which Mr. Brooks has alluded. They assimilate food better than any other animal, I think, ever known anywhere. They fat very easily, and they can be kept upon less than any other animal of the same weight that has ever been known upon a farm. I have myself a grade Percheron mare that sometimes almost alarms me by the small amount of feed to which she is restricted. If she has any idle time, her feed has to be shortened at once; if not, she puts on fat as if she was intended merely for that purpose. They are the cheapest horses to keep in that respect, and that is one of the things that ought to be considered in determining what breed of horses to keep. It is an object to have animals that mature early. Some of the trotting families that I have known do not mature until they are eight or nine years old, and then they are "lathy," "tucked-up," and great eaters, often with bad digestions, and give a great deal of trouble in that regard. The contrary is true of the Percherons. They are good eaters, have good digestions, are well-tempered and easily managed. They have every qualification about them that fits them for the farmer's use.

Allow me to recall your attention to the paper read by Mr. Slade, — it was very able and beautiful. There are men here, I know, who want to discuss it. I have seen it in the expression of their faces. I felt a great deal of disappointment, after Mr. Slade finished, that there was not something more said about it. We have time now to enter upon the discussion of that admirable paper.

Mr. Ware. I will say that I watched carefully all the way through Mr. Slade's reading, hoping that I might find some position which he took that was open to criticism, but really I saw no chance for anything except for admiration. He told us some wholesome truths with regard to the requisites of success in agriculture. He must have had, I think, a great deal of practical experience to enable him to give such a clear and concise idea or description of the qualities necessary for success in agriculture. It seems to me that there is very little to discuss in that paper. Some essays that have been read here and at other meetings have opened such wide gaps for discussion that debate upon them might last a long while, but I see nothing in this paper that is open to criticism or that calls for anything except for approval. I admire it very much indeed.

The CHAIRMAN. I will call upon Colonel Wilson.

Col. HENRY W. WILSON. All I can do, Mr. Chairman, is to show myself. I heard responses made about me that there was no disagreement in regard to that paper, and that is the word that we can all say.

I have noticed a sort of general idea among farmers that if they have made a specialty of any department in agriculture or husbandry, they have somehow ceased to be farmers. Now, if you go into a shoe-shop, for instance, where there is a subdivision of labor, you do not find shoemakers, — you find heelers, trimmers, lasters, and so on. So if you go into a machine-shop, you see a man who works at the drill, the planer or some other machine. He is not a machinist. That may be true enough with respect to such men, but that rule will not apply to husbandry at all. There are certain great principles that must be observed, and which are as applicable in one department of husbandry as another. It is the same in breeding. The same general principles of breeding must be observed whether a man breeds sheep, or horses or neat cattle. And so, when we come to talk of general market-gardening, the very writer of that paper, which I want to speak of as one of the most beautiful papers that I ever heard read at a meeting of this Board, was told two years ago, in a laughing way, by a member of the Board, "You are not a farmer, you are a strawberry grower." Well, I do not know how much he may have branched out into other departments of husbandry, but the fact that he is a strawberry grower shows that he understands the successful application of the true principles of husbandry to his strawberries as another man does to the crop adapted to his soil, climate and location. The man who has not moved about in a great many sections of the country can form but a faint idea of the extent to which this special husbandry is being carried on to-day; but a watchful man, by observing the changes in taste that are continually going on about him, can change from one thing to another and still meet the demand of the market. I have in mind a man who is one of the largest growers of roses that we have in this part of the country. He was telling me some years ago how he got led into the growing of roses. In one day he has sent seven thousand blooms into Boston market. He was originally a nurseryman, and thirty-five years ago he raised a miscellaneous stock and had a miscellaneous experience. About the time that the fashion for French pears came up, he caused a little invoice to be sent to him for his own use, to plant in his garden. His customers came there, and, seeing his trees, they desired one and another; and finally he found he had sold them all, and he had to get a new stock. Then he found that that was being made a specialty, and he went into it until he imported in one invoice four hundred thousand French stocks and worked them himself. The time came when the demand fell off; but while it lasted he found that this business kept him busy during the summer months merely, and he must have something to keep his men employed during the winter. He found that if he discharged the men whom he desired for his assistants during the period of budding and preparing the stocks, when that work was over he could not replace them the next season, so he went to work and erected some greenhouses and raised plants and flowers for the market, and thus kept his men busy. From that grew the introduction of roses, and just as the demand for pear trees fell off the demand for roses increased, and he is now the most successful and prosperous raiser of roses in Malden.

Take a man in Rhode Island. I went down there a year ago to examine and perhaps make some suggestions with regard to some improvements that were being made for a man who was raising pickles, — a man whose father before him had had a small farm and raised cucumbers for the market. I saw ten thousand barrels of cucumbers pickling in vats. The man is a prosperous and wealthy man, who raises cucumbers upon a hundred and eighty acres of land, — such land as scarcely any farmer could make any use of for general farming purposes. He selected it because it is adapted to his special use. It is dry, sandy loam, which has been obtained by clearing off those knolls that are to be found in all that district south of Providence. The knolls being covered with scrub oak, he clears them off and leaves the branches on the ground for protection. He meets the great obstacle to the successful cultivation of that sort of land by irrigation, and not having head enough to force the water on to his land by gravity, he has his boilers and his pumps, and whenever a piece of land wants water, he fires up his boiler and pumps the water on to it, and in that way he meets his exigency and obtains his crop.

You can all remember when it was a difficult thing to obtain a nice cantelope melon in the market; but now, by attention to the culture of that one vegetable, it is raised with great success. The entire stock of the most successful grower of green-flesh melons for the Boston market had passed away before the time of the Annual Exhibition on the 25th of September last year, and the men who took the prizes were the men who sold their crop for ten cents apiece, while he had sold his for twenty-five cents. He has discovered a way by which he can mature his crop in advance of other growers and thus obtain a much better price.

Take the cultivation of the strawberry, as profitable a crop, probably, as any man can raise, and, when grown under proper circumstances and with proper care, as certain a crop as any other. I can show you a man who has five acres of strawberries every year, and keeps up the fertility of his land by general culture. He told me that he raised his best strawberries on his poorest land. Why? Simply because he realizes the great demand of the strawberry for water, and meets that demand. He has water under control, and when his plants need water they have it. The result is, that on his poorest land he is able to raise his best strawberries.

I have nothing to say in contravention of the paper, but only in enlargement or amplification of it. I think you will find that the man who desires to achieve large success in any branch of husbandry can only be successful by devoting himself to that one thing. But the question naturally arises here, What is success? The common understanding is that he achieves the greatest success as a farmer or citizen who accumulates the most money. I do not accept that criterion. I consider that the man who achieves the greatest success is the man who does as Benjamin Franklin said of his father: "Without an estate or any gainful employment, by constant labor and honest industry, he reared a large family reputably." You will find this on the stone in the Granary Burial Ground. There is no collocation of words in the English language that can, to my mind, express more adequately the true idea of success in life, — "To rear a large family reputably, without any estate or gainful employment"; and if that can be brought into correlation with competence and the acquisition of those things which tend to make life comfortable, enjoyable and happy, then we have achieved the highest type of success.

We often see men of whom we say that they have been successful farmers, and you will excuse me if I make allusion to a little experience that I had in that regard. On one occasion I attended a meeting where the subject under discussion was successful husbandry, and one told how he had raised a large quantity of onions, got a great price, and made large gains; another man told how he had raised strawberries and been very successful; another man had raised turnips, another cauliflower; and then a gentleman was called upon, a man of fine presence, and he was introduced as one who had been highly successful in agriculture. He had acquired property, so that in the decline of life he could live in comfort without labor, simply from the accumulations that he had made by the successful practice of the art of husbandry. Then they called me out, pretty much as I am called out here, not because I had anything special to say, and possibly because you thought perhaps I would make a better speech for the very reason that I did not know anything of what I was talking about. I spoke then pretty much as I am speaking now. I said that I considered the successful man the man who stood in his place, did his duty in life, and educated his family; and when any man claimed to be successful, I wanted to know what he had done to see that his place in the world was ably and creditably filled when he passed away; I wanted to know how his wife lived;

I wanted to know how much of his success had been due to her labors and her sacrifices; for I see, as I go up and down the land, that the burdens of the farm and the home are not borne by the man, they are borne by the industrious, devoted and self-sacrificing wife. (Applause.) That has been my experience in life; and it proved true then, as it will prove true in too many cases, that the man's success had been bought at the sacrifice of his wife. She had broken down under the trials, the labors and the exacting demands upon her physical strength, and she was a confirmed invalid, while he was a well-kept man.

Now, you have got to take these things all together, and I think the time is now coming when the husbandman of this country must say to himself, "Here I am, a member of the community; I have my family to rear; it is my aim, my ambition, to rear them in comfort, so that they shall become creditable members of society when I pass away. I must do what I can to promote their comfort and happiness, provide for their education and support, and leave me in such a position that, as my productive power diminishes, I can live upon the little accumulations that I have acquired." I may illustrate this point. It comes right in here. Many years ago I wrought in a machine shop, where I commenced my active life. There was a young man who wrought at a bench by my side,—a very quiet, plethoric man, but a man upon whom you could always depend to do the very best that was in him. He was never employed at great wages; probably never commanded over $2.25 a day. That was thirty-five years ago. I met him ten years ago. I said, "Well, friend Tilden, how are you getting along?" He told me he had prospered in a moderate way, and then he unfolded to me the secret of his purpose in life. He said that when he was a workman he always intended to live within his means, laying up something, for, said he, "I realized that I should not always produce as much as I was producing then. I always laid by a little something so that as the years gathered over me and I began to decline, I should have something to make me comfortable." He is a man sixty years of age, is in possession of a comfortable property, so that he is not obliged to labor at all; he has reared his family so that they are all creditable members of society, and in the decline of life he is respected and happy. That man has been a success. He is not a great man in the eyes of the world; he is not a scientific man; he is not gifted with those bright and shining accomplishments which command the admiration of the world; but he has filled his place, he has done his duty, he has kept himself respected, and as he grows old he knows that he will leave behind him those who will fill the place creditably that he has filled. That is success in life, and that success can be achieved by every man of sobriety, energy and industry. (Applause.)

Adjourned to 7.30.

EVENING SESSION.

The meeting was called to order by Mr. GODDARD at 7.30. Mr. EDMUND HERSEY of Hingham was introduced, who delivered a very interesting lecture on Experiments in Potato Culture, illustrated with Stereopticon.

LECTURE ON EXPERIMENTS IN POTATO CULTURE.

[Illustrations at the end of the Lecture, after page 118.]

BY EDMUND HERSEY OF HINGHAM.

Members of the Board of Agriculture, — The subject of potato culture has not again been brought before you because of the discovery of many new facts since last year, but because I believe that I possess better means than ever before of proving to you the truth of my assertions, and because of the desire to show you the practicability of making true and lasting records of agricultural experiments, in different stages of progress, by that wonderful art which has been so perfected that the exact form and position of the trotting horse, while in action, can be gathered up and preserved for future examination. With what delight would we gaze upon what we felt sure was a true picture of a field of corn as cultivated by the Indians or the Pilgrims; and how interested we would be in looking at photographs of the cows milked by our great-grandmothers, or of the hogs fed by their sons;

and how much more fully we would realize the progress we have made, could we have for examination true pictures of the grain fields, the gardens, the different animals, fruits and vegetables of a hundred years ago! But the greatest advantage of a picture record is in furnishing the means by which more correct conclusions can be drawn as to the value of any particular method to secure a desired result.

A photograph is not only a lasting record, but it is a true record, which, in most cases, cuts off highly colored statements of enthusiastic experimenters. The photographic art is of so recent discovery that our ancestors could not, if they had desired to, preserve the true picture forms of their farm products; so we cannot accuse them of not doing their duty, because they did not preserve in picture form their farm crops. But not so with us. We have the means by which nearly every step of progress and every mistake in agriculture can be easily and correctly recorded, and if we neglect to do it, we shall neglect a duty we owe to posterity. This is a work so important that it should not be left to be done by individual effort, but it should receive State and United States aid; and thus, by combined efforts, every important experiment and every step of progress could be gathered up and deposited at central points for future examination and comparison.

Let us make some effort to have a small portion of the money which our government spends so liberally used for making picture records of carefully tried experiments, made at our experiment stations, and thus begin the work of preserving in true forms, for the use of posterity, as well as our own instruction, whatever may be of value or of interest.

The Massachusetts Society for the Promotion of Agriculture has, with its usual generosity, paid most of the expense of the views that I am about to show you, and also paid for forty-nine photographs to be deposited at the Experimental Station at Amherst. The very quiet and efficient manner in which this society is aiding agricultural progress is worthy of all praise, and should receive the thanks of every friend of agriculture.

The land upon which the experiments I am about to bring to your notice were tried was a light, sandy loam. It had been planted several years with hoed crops of various kinds, and had been well manured, so the soil might be said to be in fair condition. Early in May the land was ploughed about seven inches deep; no manure was spread broadcast, because it was thought the test would not be as correct as it would be to measure out an exact amount of fertilizer and apply it to each hill. The fertilizer used was made of ground bone and sulphuric acid, with enough well decomposed leaf-mould mixed with the bone and acid while hot, so that one quart could be applied to each hill at a cost of one-half cent, or twenty dollars an acre. The fertilizer was well mixed with the soil over a space eighteen inches in diameter.

The first experiment which I shall call your attention to shows the results of a test of the value of small whole potatoes as compared with large cut ones, the small potatoes being about one inch in diameter, and the pieces were cut from potatoes weighing about one-half a pound each, and cut of a size to weigh exactly the same as the whole small potatoes, each whole potato and each piece having the eyes reduced to two before planting. May 19 the seed was planted. The first view was taken June 28, and shows the plants when well up. Four hills were taken instead of two, there being twenty hills in this experiment. It will be seen that No. 1, from the small whole seed, shows the largest. July 21 another field view was taken. You will observe that No. 1 is still in advance of No. 2. This has always been the case every year of the seven years which this experiment has been under trial, the whole seed being from a week to ten days earlier than the cut seed. The potatoes in each hill were dug, assorted, and weighed and photographed. The next view shows the potatoes dug from each hill, No. 1 from the small potatoes, and No. 2 from the large cut potatoes. The result this year does not exactly compare with the six preceding years, owing probably to the fact that when No. 1 was making the most rapid growth of tubers the weather for several days was excessively hot and dry, but changed before No. 2 had reached a stage of growth to be so seriously affected. The weight of No. 1 was, of large potatoes, 5 pounds 14 ounces; small, 2 pounds; total, 7 pounds 14 ounces. No. 2 produced, of large potatoes, 7 pounds;

small, 1 pound 2 ounces; total, 8 pounds 2 ounces. For the seven years, No. 1 produced 205⅛ pounds of large and 62 pounds of small potatoes. The same number of hills of No. 2, the cut seed, produced in the same time 192⅝ pounds of large and 71¾ of small potatoes, — the small whole seed producing 13 pounds more of large potatoes and 9¾ pounds less small ones than No. 2, the seed cut from large potatoes.

The next experiment is to show the different ends of the potato, No. 3 being the seed end and No. 4 the stem end. The next view shows the plants as they were June 28; the next is a field view taken July 21. These views all show that the seed end produced plants that kept in advance of those that came from the stem end, but for some reason these two hills show more difference than the other eighteen hills in this experiment; yet every year during the six years which this experiment has been under trial, the plants from the seed end have started in advance of those that came from the stem end.

The next view shows the result of this experiment. No. 3, seed end, produced, of large potatoes, 4 pounds 8 ounces, and 1 pound 10 ounces of small; total, 6 pounds 2 ounces. No. 4, stem end, produced, of large potatoes, 4 pounds 4 ounces, and of small, 1 pound 2 ounces; total, 5 pounds 6 ounces. For six years the ten hills of each number produced, No. 3, seed end, 166½ pounds of large potatoes and 47¼ of small; total, 213¾ pounds. No. 4, the stem end, produced 141⅜ pounds of large potatoes and 47⅛ of small; total, 188½ pounds, — the seed end producing 25 pounds more large potatoes than the stem end, and about the same quantity of small potatoes.

The next experiment is to show the difference between large and small potatoes for seed. The result is not satisfactory, and I cannot help thinking that if the experiment be continued seven years, most of the yearly results will be different; but I give you the result of this single experiment, with the caution not to draw any conclusions to be used, until more trials of the same experiment have been made.

A 1 is a large potato weighing about one-half a pound. A 2 is a small potato about one inch in diameter. The small potato was cut in the centre, and each half reduced to two eyes; then two pieces were cut from the large potato, of exactly the same weight of the pieces from the small potato, and all but two eyes in each piece destroyed; the pieces from the large and small potatoes were planted in hills side by side. The field view taken June 28 shows that the seed from the small potatoes started first, A 2; and the second view, when the plants were full-grown, shows a larger growth. The next view shows the result. It will be seen that A 2, from the small potato, has a large number of quite small potatoes at the top of the view. These were a late growth, and were on the stalks very near and some about the surface of the ground; but aside from these there is a much larger number of good potatoes than in A 1, which come from the seed of the large potatoes, there being only four in A 1 large enough for eating, while in A 2 there are nine. A 1 produced 14 ounces of large and 1 pound 6 ounces of small potatoes; and A 2 produced 1 pound 2 ounces of large and 2 pounds 4 ounces of small potatoes. The small quantity from these two hills was undoubtedly owing to the small amount of seed used.

The next experiment was made to show the advantage of covering a cut potato with plaster. B 1 was covered with plaster immediately after being cut, B 2 was left uncovered, and both were planted in a few hours after being cut. The view shows that the covered potato started first, and the next shows that the uncovered potato did not make so strong a growth as the covered. The result as shown in the next view is not so much in favor of the covered seed. While the total yield was larger, the weight of good eating potatoes was less. This was, no doubt, owing to the hot, dry weather which came just in time to check them when making the most rapid growth; while B 2, not being quite as early, was not injured. B 1, the covered seed, produced 2 pounds 10 ounces of large and 2 pounds 12 ounces of small potatoes; total, $5\frac{3}{8}$ pounds. B 2, the uncovered seed, produced 2 pounds 14 ounces of large and 1 pound 14 ounces of small potatoes; total, $4\frac{1}{8}$ pounds.

The next experiment was to test the difference between light and heavy seeding, or single eyes and whole potatoes.

Two potatoes, each weighing about one-half a pound were selected, and from each, one of the strongest eyes were cut out with a small piece of potato attached. The two eyes were planted in one hill, and the two whole potatoes, less one eye each, were planted in the next. The next view shows how much quicker the whole potatoes started up a luxuriant top than the single eyes. In the numerous trials which have been made in years past, this has always been the result, — the whole potatoes outstripping the single eyes by more than one-half. The next view, showing the plants at full growth, gives unmistakable evidence that a tuber has the power to feed the young plant, and force it to a degree that is far beyond what the plant food in the common soil can do. The next view shows the result, which is very much in favor of the whole seed. E 1, the single eyes, produced 2¼ pounds of large, and 10 ounces of small potatoes; total, 2⅞ pounds. E 2, the whole potatoes, produced 8 pounds 6 ounces of large and 1 pound 10 ounces of small potatoes; total, 10 pounds, the product from the whole potatoes being more than three times that from single eyes. The seed for this experiment was the variety called the White Star. The same experiment was repeated with seed of the early Plymouth County, which is the variety used for all of the other experiments tried. This experiment shows very nearly the same results as the one just given. F 1, the single eyes produced 1 pound 14 ounces of large and 6 ounces of small potatoes; total, 2¼ pounds. F 2 produced 4 pounds, 10 ounces of large, and 2 pounds, 4 ounces of small potatoes; total, 6⅞ pounds, or a trifle over three times more than the single eyes produced.

The next experiment was tried to show the difference, if any, between seed that is scabby, and seed free from scab. G 1 is a very scabby potato, and G 2 perfectly free from scab. For some reason these potatoes did not appear above ground in time to be photographed June 28, and so no view was taken until July 21, when, as you will observe, the growth of each was very near alike and the potatoes, though a very small crop, were very near alike; and all the potatoes in both hills were entirely free from scab. This experiment has been under trial three years with the same results. I cannot account for this, and am not convinced that it is good policy to plant scabby potatoes. I should rather have a trial of three years more with the same results, and also should prefer to have others try it before settling down to any definite conclusions. It is so different from what one would naturally expect, that there should be stronger evidence than three years' trial before anything of value should be considered established.

The next set of views, and the last that I shall bring to your attention this evening, shows the result of an experiment to test the value of salt to prevent scab. It having been said that salt will prevent scab, I decided to commence a series of experiments to ascertain if it be true. This year being the first of the experiment, the result is of no great value; but I give it, with a caution not to draw conclusions until further experiments are made. H 1 and H 2 are potatoes badly affected with the scab. These were cut as near in the centre as possible, and one-half of each put in one hill and the other half in the next hill. The hill marked H 1 had a small handful of coarse salt mixed with the fertilizer and the soil directly around the hill. H 2 had no salt in the hill. The view taken June 28 shows that the plants in the hill salted started first, and the view taken July 21 shows that the plants kept in advance of those not salted; and the potatoes when dug show H 1 to be much better than H 2, H 1 producing 4 pounds 10 ounces of large and 14 ounces of small potatoes, — total, 5½ pounds; H 2 produced 3 pounds of large and 6 ounces of small potatoes, — total, 3 pounds 6 ounces. I give you this, not because I believe that salt will always produce such good results, for I do not; but I give it to show the importance of more than one trial before conclusions are drawn. This experiment will be continued. No scab was seen in the hill salted or in the hill not salted.

In conclusion, I would say, years of close observation and careful experiments lead me to the following conclusions: 1st, Whole potatoes will produce a crop from a week to ten days earlier than cut potatoes. 2d, Small whole potatoes will produce for many years in succession just as good if not better results than large potatoes cut the size of the small whole ones. 3d, The seed end of a potato is better to plant than the stem end, because the plants start with more vigor, and produce larger and more potatoes. 4th, A large piece of a potato is better to plant in ordinary soil, and will produce a much better crop, than very small pieces or single eyes. 5th, Potatoes with sprouts long enough to break off in planting are not as good as potatoes with the eyes started just enough to show their good condition. 6th, The form of a potato cannot, as a rule, be changed by the selection for planting any particular form. 7th, Two distinct varieties will not mix by planting in the same hill. 8th, The potato scab is a blemish that the more we investigate the less we appear to know about it.

First Experiment.

No. 1, small potatoes; No. 2, large cut.

	Large.		Small.		Total.		Acre.
	lbs.	oz.	lbs.	oz.	lbs.	oz.	bush.
No. 1, . .	5	14	2		7	14	525
No. 2, . .	7		1	8	8	2	601⅔
							26⅔
No. 1 (7 years),	205⅛		62		267⅛		
No. 2 (7 years),	192⅝		71¾		264⅜		

The small seed producing 13 pounds more of large potatoes, and 9¾ less of small.

Second Experiment.

No. 3, seed end; No. 4, stem end.

	Large.		Small.		Total.		Acre.
	lbs.	oz.	lbs.	oz.	lbs.	oz.	bush.
No. 3, . .	4	8	1	10	6	2	408⅓
No. 4, . .	4	4	1	2	5	6	358⅓
							50

The seed end for six years produced, —

	Large.		Small.		Total.		Acre.
	lbs.	oz.	lbs.	oz.	lbs.	oz.	bush.
No. 3, . .	166½		47¼		213¾		
No. 4, . .	141⅜		47⅛		182½		
	25⅛		⅛				

THIRD EXPERIMENT.

A 1, large cut potato; A 2, small cut.

	Large.		Small.		Total.		Acre.
	lbs.	oz.	lbs.	oz.	lbs.	oz.	bush.
A 1, . .		14	1	6	2¼		150
A 2, . .	1	2	2	4	3	6	225
							75

FOURTH EXPERIMENT.

B 1, covered seed; B 2, uncovered.

	Large.		Small.		Total.		Acre.
	lbs.	oz.	lbs.	oz.	lbs.	oz.	bush.
B 1, . .	2	10	2	12	5⅜		358⅓
B 2, . .	2	14	1	14	4¾		316⅔
							41⅔

FIFTH EXPERIMENT.

E 1, single eyes; E 2, large potatoes.

	Large.		Small.		Total.		Acre.
	lbs.	oz.	lbs.	oz.	lbs.	oz.	bush.
E 1, . .	2	4		10	2⅞		191⅔
E 2, .	8	6	1	10	10		666⅔
							475

E 2 being more than three times E 1.

SIXTH EXPERIMENT.

F 1, single eyes; F 2, large potatoes.

	Large.		Small.		Total.		Acre.
	lbs.	oz.	lbs.	oz.	lbs.	oz.	bush.
F 1, . .	1	14		6	2¼		150
F 2, . .	4	10	2	4	6⅞		458⅓
							308⅓

F 2 producing a trifle over three times that of F 1.

SEVENTH EXPERIMENT.

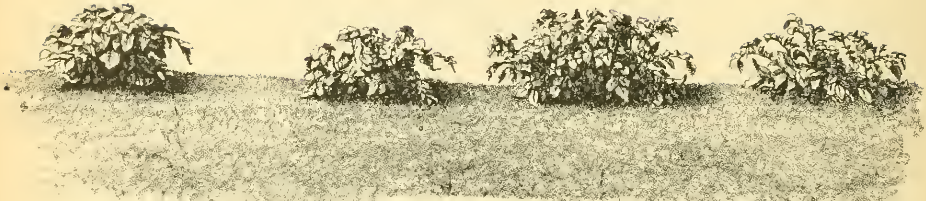
[Not tabled.]

EIGHTH EXPERIMENT.

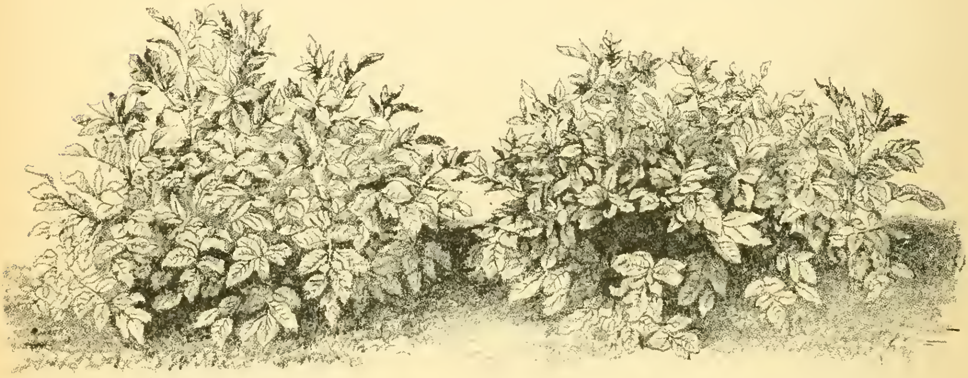
H 1, salted; H 2, unsalted.

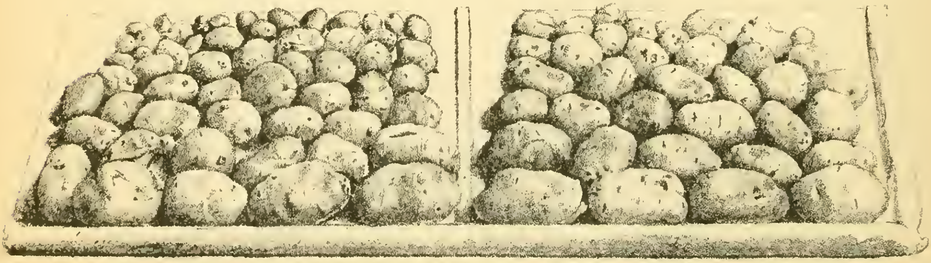
	Large.		Small.		Total.		Acre.
	lbs.	oz.	lbs.	oz.	lbs.	oz.	bush.
H 1, . .	4	10		14	5½		366⅔
H 2, . .	3			6	3	6	225
							141⅔

FIRST EXPERIMENT.

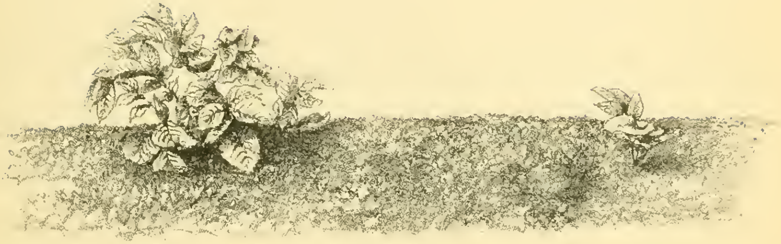

June 28th.

No.1. No.2. No.1. No.2.

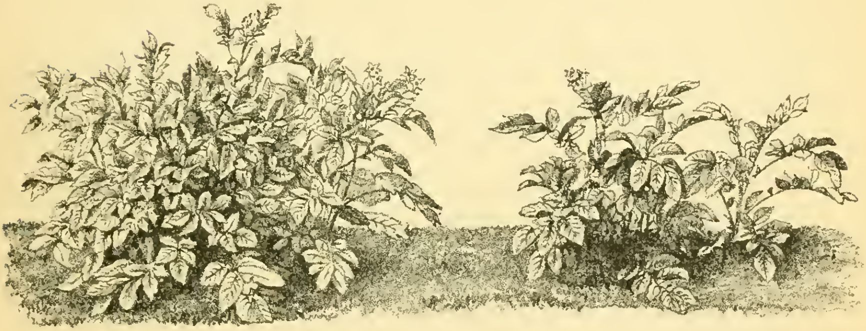

No.1. July 21st. No.2.


No.1. Result. No.2.

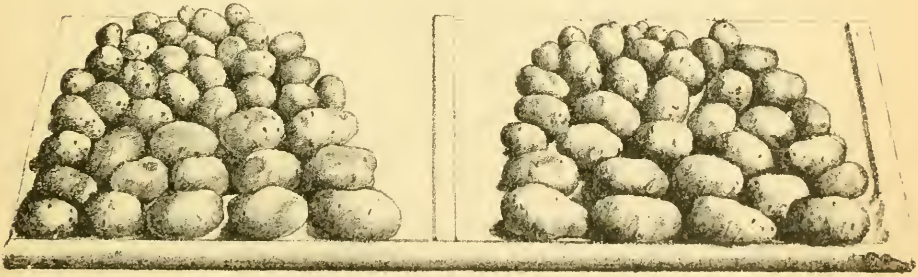
SECOND EXPERIMENT.



No.3. June 28th. No.4.

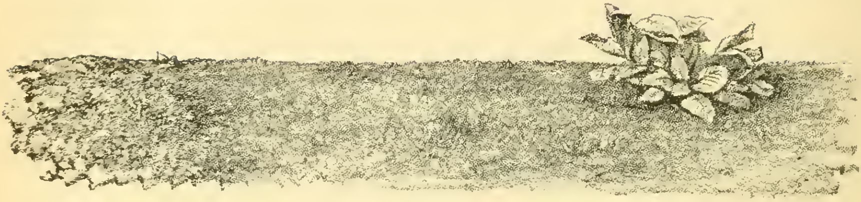


No.3. July 21st. No.4.

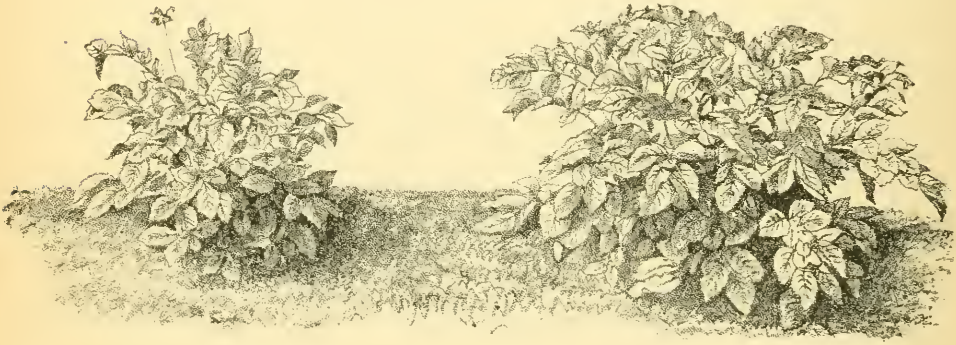


No.3. Result. No.4.

THIRD EXPERIMENT.



A1. June 28th. A2.



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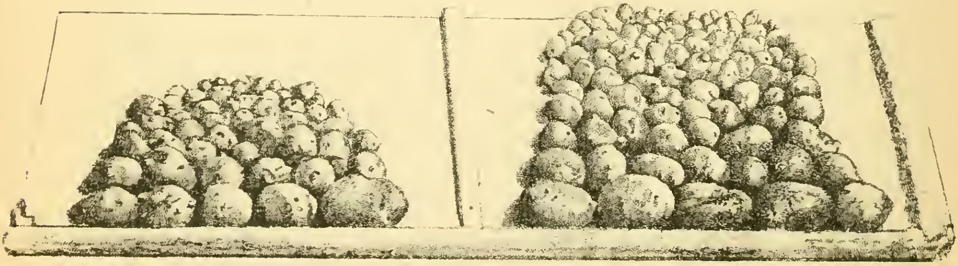
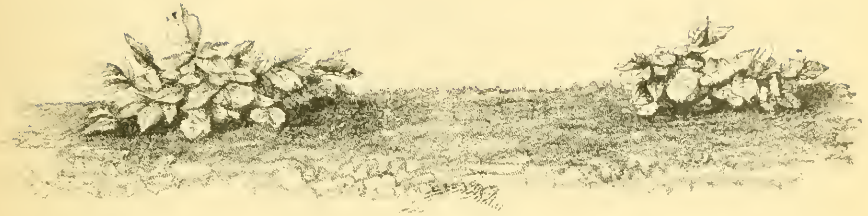
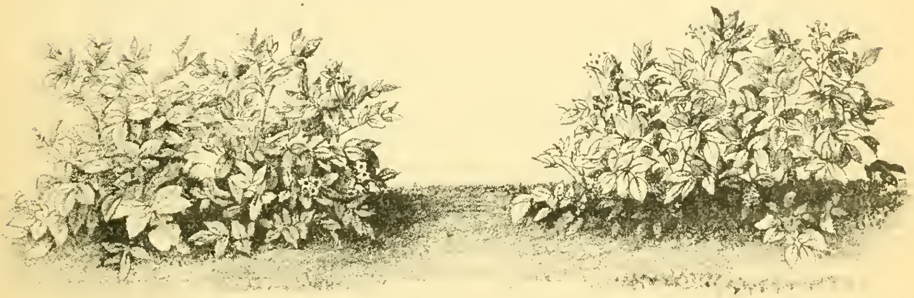


A1. Result. A2.

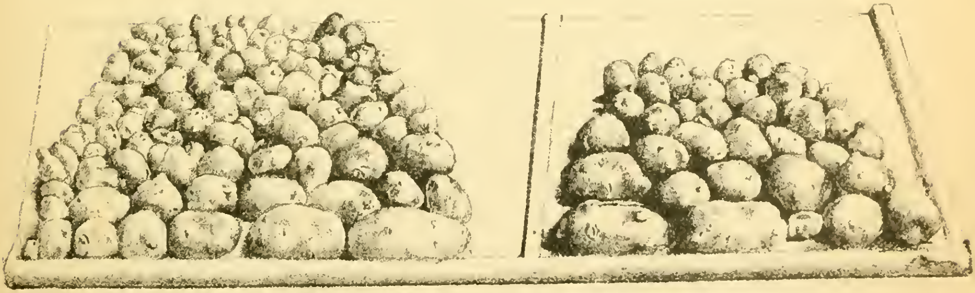
FOURTH EXPERIMENT.



B1. June 28th. B2.

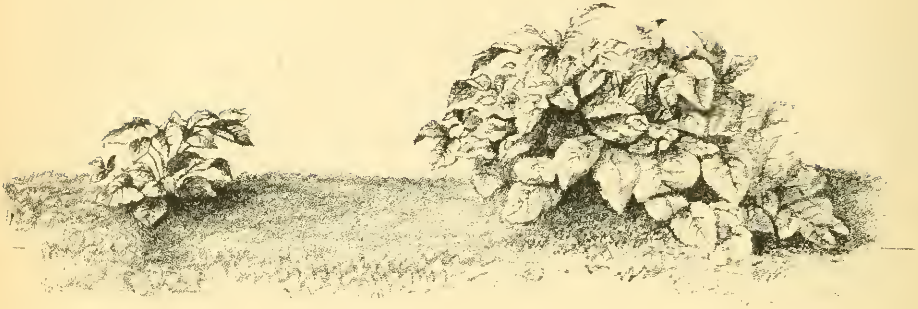


B1. July 21st. B2.

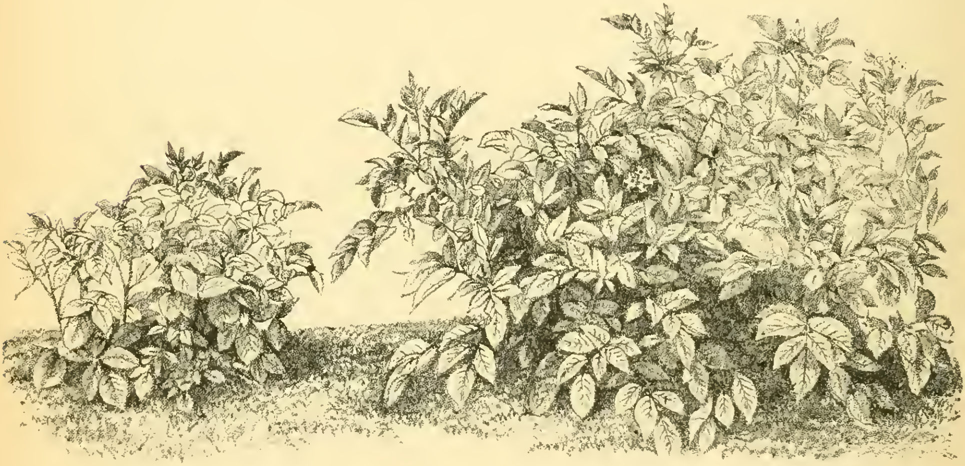


B1. Result. B2.

FIFTH EXPERIMENT.



E1. June 28th. E2



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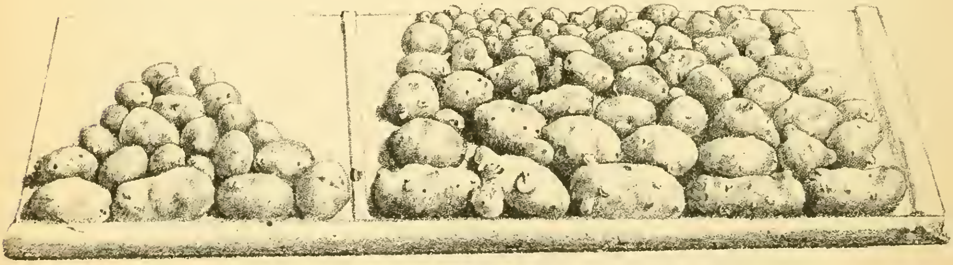
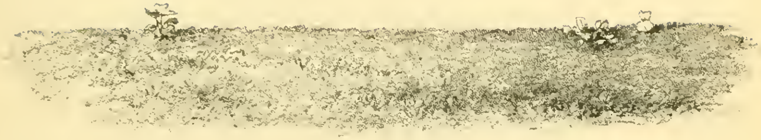
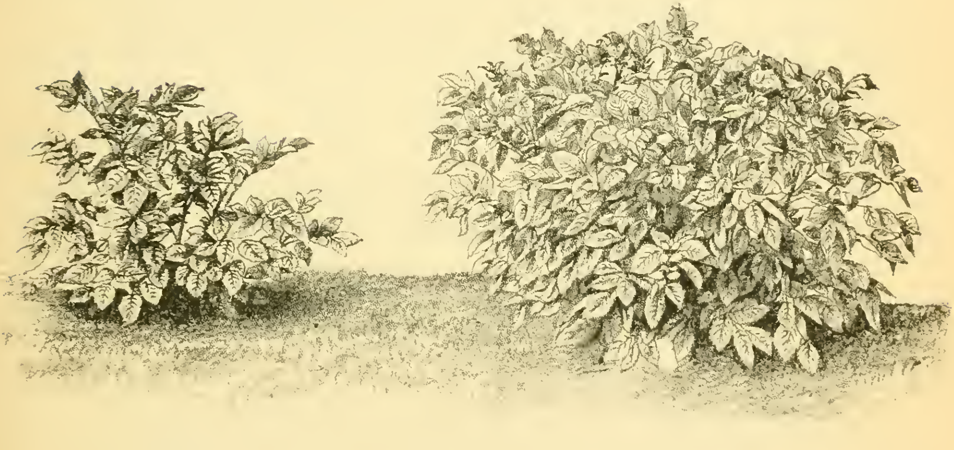


E1. Result. E2.

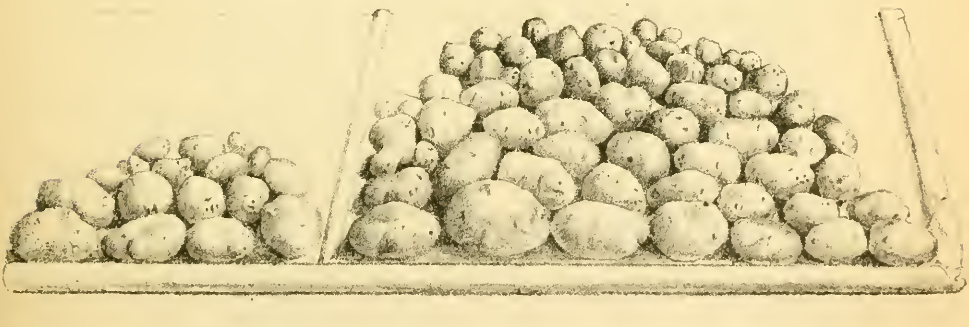
SIXTH EXPERIMENT.



F1. June 28th. F2.

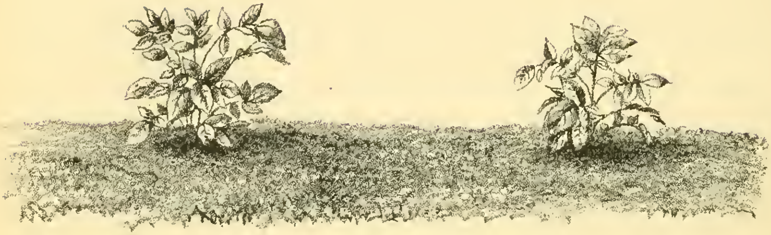


F1. July 21st. F2.

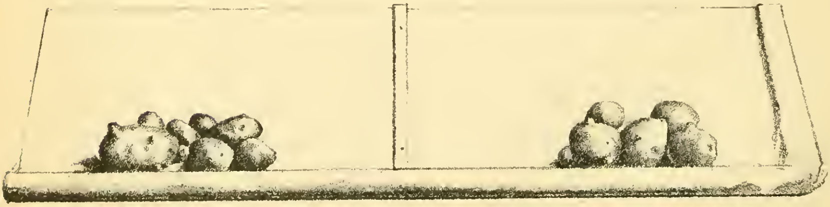


F1. Result. F2.

SEVENTH EXPERIMENT.



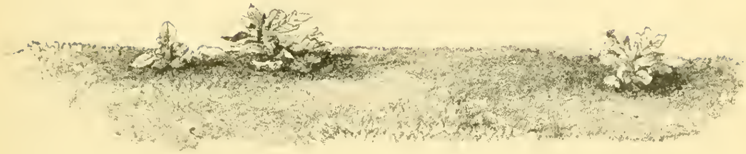
G1. G2.



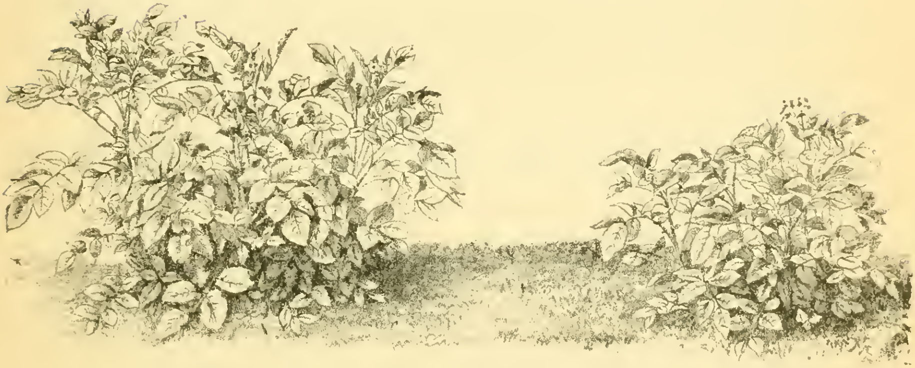
G1. G2.

Result.

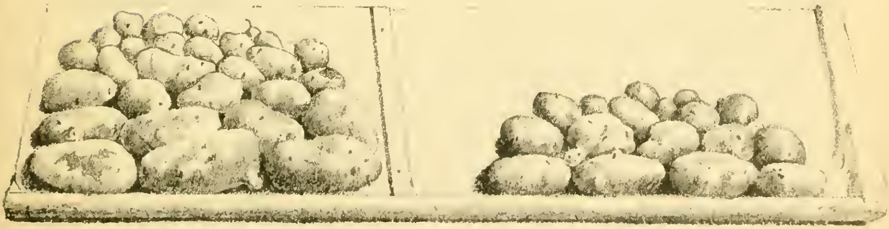
EIGHTH EXPERIMENT.



H1. June 28th. H2.



H1. July 21st. H2.



H1. Result. H2.

SECOND DAY.

The meeting was called to order at 9.30 by Mr. GODDARD, who said:

I congratulate you on the good attendance we had yesterday and on the close attention that was paid to the papers and discussions. We have the promise to-day of a large attendance, and we certainly have a very full programme. You will remember that one lecture which was to have been given yesterday was postponed until this morning, and so the day, which we thought was already full, will be overflowing, but I hope overflowing with good things, and I believe so.

It gives me great pleasure to introduce Mr. APPLETON, who will give his lecture on Reclaiming Land.

RECLAIMING LAND.

BY F. H. APPLETON OF PEABODY.

Mr. President, Ladies and Gentlemen, — When asked to prepare a lecture for delivery at this time, which I knew would be listened to, not only by the representative agriculturalists who compose this Board, but also largely by the citizens of this famed agricultural town and county, with their visiting friends, I indeed hesitated to inquire what I could say to such well-trained and tried farmers that would be new or interesting.

I have prepared a few remarks, hoping that I might, at least, advance some ideas which would be suggestive to farmers, as well as to those agriculturalists who are indirectly interested in the cultivation of the soil, and who are unable to be present during this meeting.

It is the absentees whom the published reports of your Board in large measure benefit, besides being preserved for study and reference by many Massachusetts yeomen, and also going forth far beyond the State boundaries as an exponent of what is being done here in the interests of agriculture.

There are a few subjects which I will touch upon only briefly, and which are either important to-day, or destined soon to be requisites, in our general system of New England farming.

While my subject might lead one to suppose that I should endeavor to explain to you new methods of farming by which you could make that part of your land profitable which to-day is useless, my object will really be to endeavor to persuade Massachusetts farmers to consider more carefully whether they cannot treat much of the land on their farms in more profitable ways than those adopted by them to-day.

The adaptability of crops to land is the subject that I would urge farmers to carefully consider; and to do so intelligently, a study of the annual reports of this Board is an admirable aid to the solution of the problem, whether it be to change or modify existing methods, or to become assured that the methods at present adopted are best suited to the farms under consideration.

Every possible influence should be judiciously used to aid the Secretary of this Board, not only to secure a thorough circulation of the reports, but to urge farmers to more generally and carefully read and study their contents.

We should use every influence to make the good words and advice that the reports contain fully felt and appreciated by those farmers who do not now make a practice of seeking and reading them.

Is it not in the extension of agricultural knowledge among the people of the State that we find the good influence of the Agricultural College is being felt, besides the direct benefit to the individuals who graduate from it?

I have heard some people criticise the college by saying that too few graduates become farmers. Is that all that young men go to the college for? By no means. Those who do not turn practical farmers, become citizens whose influence must be felt throughout the State or country, in the field of agriculture; and such men are on hand to protect and foster the farming interests of the nation.

Agriculture is a combination of almost all the known sciences, and consequently every *student* of science is doing his part towards advancing and improving this great combination of arts and sciences.

The winter meetings of the Board, and those of her children the farmers' clubs, are the stages upon which words of knowledge and advice can be brought usefully before the farming community.

To clearly ascertain the truth as to the adaptability of crops to land or land to crops, systematic and business principles play a most important part.

In this prosperous and fertile town and county I am sure that the *immediate need* of the strictest economical principles of cultivation has not yet been forced upon the farmers, as has been the case in many parts of the State; but I am sure that the best methods of management have been, voluntarily, adopted here; and have also been adopted elsewhere, wherever the reputation for good farming is such as is that which is well known to apply to Barre.

In travelling through less fertile and less favored sections of the State I have wondered whether the owners of such poorer lands do not wish that reliable farm doctors existed, who could be called to those less profitable farms, and be sufficiently well trained to advise in what way they could be treated or cultivated to better advantage, both in the interest of the owner and indirectly in the interest of the State.

In 1870 I went about half-way in getting such advice in regard to the treatment of an obstinate field about which I could not make up my mind just what it needed. I sought the advice of a well-known chemist, but found that he could not view the field. He heard my story, and then told me to bring him a collection of samples of the earth taken from different parts of it.

This I did, and in due time I received his reply. A liberal dressing of lime in late autumn was advised, with potash and other fertilizers in the spring, in quantities per acre as stated to me for a specified crop. It was intended not only to supply direct food to the crop by applying the chemical fertilizers to the soil, but also to promote such chemical action with the soil itself as would liberate an increased supply of plant food.

All the scientific recommendations were carried out, but the crop was unsuccessful, or almost a failure.

After considering the character of the soil, and reviewing the debit and credit sheets of my account book in regard to the crop, it was decided to abandon all further general cultivation of that field. I therefore tried to start some grass there, and have now on part of it a poor pasture, and on the balance a good growth of a mixture of forest trees. If the field were larger, I think it might be improved by pasturing sheep there, provided they should be fed with rich food to increase the value of their manure.

How to enable the owners to improve their poorer lands *is* an important matter to the State, if land is being held at a loss, and is not of sufficiently good quality to yield profitable returns.

There seems to be much land in Massachusetts to-day which would be more profitable if planted judiciously to trees, or otherwise treated than at present.

The effort that is being made to improve much of our upland by increasing sheep husbandry deserves all the encouragement that it can receive. The value of well-fed sheep as a means of renovating land is great, and those who are agitating this subject should receive all possible aid.

In improving the lower lands that require drainage, and to be cleared of woody and rough growth, we find the reclaimed land of so high a quality as to invite either cultivated crops or heavy grass land, depending largely upon nearness to market.

It is on such land that crops can be made to thrive after they have been judiciously treated by drainage and fertilization; and there, where they have useful amounts of moisture even in seasons of drought, that chemical fertilizers can be used with almost unerring effects; and where the hard work of the farmer can be expended with as sure a promise of good returns at times of harvest as anywhere.

There are farms to-day where the main-stay is the lower land, which bears three tons or more of hay to the acre, while the old uplands, that father and grandfather have made sacred by cultivating and mowing for years, yield a harvest of perhaps only one, or one and a half, tons to the acre.

There still is much land where trees can be planted to a good profit, and I shall soon refer to methods and cost.

But the question now arises, how are we to know that any part of our land is yielding a poor income, or perhaps is losing property.

It is probably a generally recognized principle with the farmers of Barre and vicinity to keep careful accounts with their different fields or crops, and to measure or weigh at the time of harvest; but such, I am quite confident, is not the majority rule among farmers, but I wish for their own good it were so.

A systematic management in any business or occupation is the true and only way to know when we are reaping the best results, and no people more than the farming community deserve success in their calling.

I am no advocate of complicated accounts, but advise a carefully kept diary of what the daily work has been, and where it has been done, so that a balance sheet can be made from it, in order that it may be known what is worth doing and what is not.

This subject is an old one, but it is none the less one that will bear repetition in order that more persons may fall into line and benefit by its adoption.

It is in the hope that land which is being tilled at a loss may either be devoted to some other plan of treatment, or be so cultivated in the future that it shall yield at least a fair return to its owner, that I would urge the importance of keeping accounts in some simple form proportionate to the extent of farming done.

Knowledge, as to *general adaptability* in connection with farming, is largely needed to aid and benefit the practical part of farming. To know how to best induce the fertility of the soil to change its character and find its way into the bank or pocket in the largest possible quantity, *via* crops or animals, yielding to the occupants of the farm a comfortable and happy living, than which no other offers greater possibilities for health and contentment, is the key to successful farming.

Where do we look for the leading exponents of this knowledge; do we not turn first towards her who now has clustered around her a large number of alumni who cherish strong affection for their agricultural Alma Mater at Amherst?

To the Agricultural College and Experimental Station we look for aid, and trust that they will receive all proper help and encouragement in their good work to educate and develop.

To refer more especially to forestry: —

Last year there was published in the Annual Report of the State Board of Agriculture an interesting essay on forest trees by Professor Sargent, which deserves the careful attention of every intelligent citizen of the Commonwealth.

Because an essay is a year or more old is no reason why it should be laid on the shelf, although, more often, what is news to-day is not such in the future.

We know how some republications often are in far greater demand than new books; and, although the subject of forestry, and forest and ornamental trees in general, cannot be expected to attract the attention of as many people as a popular novel, it is a subject that deserves far greater study than is accorded it to-day. In saying so, I have in mind the value to our State of a more general understanding of the merits of a judicious care and planting of trees, in both large and small quantities, on farms, along roadsides and on home grounds, in villages and cities. I use the word "villages" instead of "towns," because most towns are made up of collections of villages, and village improvement societies afford a better means of effecting local improvement than do larger organizations; also because there are a considerable number of village-improvement societies in existence to-day, or organizations that have local improvement for their object, and which are doing good work.

It is said that in some localities farming is less profitable than formerly, or perhaps it might be more truly said that the income derived from the farm is insufficient to meet the increased expenses that education of the present day leads many to believe is necessary.

Every possible effort should be made to advance the condition of agriculture, and all suggestions that may propose new plans for utilizing the land should be placed before the people.

There must be many cases in the State where tree culture could be profitably practised, and the ornamentation of villages, roadsides and home grounds is no small part of such profit.

Why should not Massachusetts aim to become even more of a garden State than she now is, attracting hither in greater numbers than now those seeking homes in country districts, retired from the more busy centres of trade; and to make the localities where trade and manufacturing is conducted more beautiful, by fostering and guiding natural growth, so that the scenery which is peculiar to the country may surround and improve the office and workshop, as well as the homes of those who toil with mind and body.

Our population is gradually increasing, and the Western States offer many attractions to our younger men to leave their mother State and establish themselves elsewhere.

It becomes our duty, as citizens of Massachusetts, to leave no stone unturned to keep all at home whom we can provide for, and to offer every good and permanent attraction that we are able, in order that the ties which bind to Massachusetts shall be so strong that even those whose business may call them away shall eventually return, and bring a fair proportion of their profits with them.

The varied geological condition of our State, with its proportion of hills and valleys, streams and lakes, affords all that we could ask for, provided the waters are to be kept unpolluted, and the lakes are not to be wastefully drawn upon as sources of water supply.

We must endeavor to preserve a correct proportion between our wood and stump land, and our tillage and pasture land; and lands that are not fit for the one use should be allowed to improve by the other.

Let me introduce one word here about much of the land that was cleared of woods by our ancestors when they first came to this country; and I do not quite understand why they cleared for cultivation so much land that would seem to be far better off as woodland than in any other condition, unless they preferred to reclaim that which could most *quickly* be made ready to yield them crops.

Because our brave and sturdy ancestry reclaimed from the woods much of the land that is still under cultivation to-day, is, *in itself*, no reason why it may not be wiser to again reclaim many of the same lands from field, pasture or waste culture, and plant to trees.

Certainly most of the land with gravelly subsoil that is so sensitive to drought, and the inland tracts that are of a more sandy character, and which go begging at ten dollars an acre, originally were largely covered by a growth of woods. And would it not seem far better if such lands should be encouraged to return to woods again? Mr. Slade of Somerset told this Board several years ago what his friends of Middleborough and adjoining towns had done for similar lands there. They were planted with that standard native tree, the glorious white pine of New England, which, from its increasing scarcity, must be gradually improving in value as the years roll on.

This town is, probably, a less fortunate locality for a lecture to be delivered which urges the reclaiming and cultivation of other land than that which is now tilled; but the value in tilling the best land you can have is so well known to the citizens of Barre, that they cannot fail to commend the importance of the old and true saying, that "what is worth doing at all is worth doing well."

This is a good principle for every one to build upon, and in the case in point every farmer should realize the value to him of cultivating his best land.

Do not continue to cultivate land for the *sole reason* that fathers and grandfathers have done so before.

If the uplands yield small crops, at once carefully consider whether you can improve them; or treat them differently, and bring the low lands into a condition for tillage.

Here is a possibility for putting in practice the truism that "in union there is strength," and for farmers' clubs or combinations of individuals to carry it out, by a union of interests, where the low lands are owned by several individuals, and the drainage can only be effected by united effort of interested parties.

Farmers' Clubs and Village Improvement Societies are the means of accomplishing more real good in these and other directions for their members than is generally done.

Much moist land is, however, not owned jointly with others, and where the work can be done with no chance of obstacles to a successful result.

If the low lands are to receive such attention and be proved a source of increased profit, what shall become of those uplands which have less attraction for cultivation? Let them be planted with valuable trees.

The plantations of Middleborough and vicinity are proof of the profit that can come from planting trees judiciously upon the poorer quality of land. It was my pleasure to view those plantations of white pine which have succeeded so well, and they are in themselves sufficient evidence of success.

The visit was made in company with two gentlemen, than whom there is no better authority on forest growth.

In making plantations, practical experience in setting out a considerable number of trees leads me to speak most forcibly *against* setting out any but the smaller sizes in new plantations; and that is a far better *rule* to follow for all planting.

Trees have been set out on my own farm of sizes from one foot to ten feet high, of both evergreen and deciduous species, in permanent places; and the smaller trees, being less affected by the winds, sooner secure a permanent and thrifty hold on the soil with their roots in their new position.

In setting out plantations, the young trees must be set reasonably near each other, so that they shall afford mutual protection.

This applies whether the trees are eventually for ornamental purposes or for forest growth. In the former case the position of the trees as they are ultimately desired must first be established, and then the intervening space should be filled in with good hardy trees which shall be cut down as the permanent ones approach them.

The plantations of the late Mr. Fay of Essex County included such a plantation of ornamental trees of varied kinds, and had he been spared a dozen years longer, he would undoubtedly have carried out his apparent intention to so thin them that the result would probably be as fine an example of extensive ornamental woodland as could anywhere be found.

When it is desired to plant for timber, the permanent trees should be planted as nearly as possible in the manner in which nature starts her successful woodland growth; the object generally being to prevent the development of limbs and encourage the main stem.

It is well to encourage the claiming back again of those lands that are better suited to be woodlands, and the reclaiming those woody and marshy lands that are well adapted for cultivation.

It is on the lower lands chiefly that science, engineering and chemistry can prove their usefulness to the State and to the farmer.

Much land that is to-day flooded, to afford water-power for mills, would probably prove as valuable as any in the State for purposes of cultivation, were the mills ever disused, water-power given up, the water withdrawn and the land reclaimed.

There is still another method of benefiting our less good lands, those which are more susceptible to draught; and I refer to irrigation.

The value of the windmill deserves a much wider recognition than it receives to-day, and the steam-pump is a far *simpler* means of irrigating and watering land than is generally supposed.

Both windmill and steam-pump deserve consideration from more farmers and gardeners, whose crops and market loads should be larger than they are to-day.

Every system of irrigation fed by windmill or steam-pump *must* have a large reservoir in which to store up a supply of water for times of greatest need. If a windmill is to be used, and you are in doubt as to which size to take, by all means choose the larger, keep it well oiled, run it constantly, and it will serve you well, with small outlay for repairs. They only need regular oiling to gain the highest place in their owner's estimation.

If you can get a sufficient amount of water from a windmill, it is the cheapest and best supply, and the larger mills can deliver a great quantity; but if that is too uncertain in any locality, the more costly steam-pump is wholly reliable.

Why is it that villages do not have more of the smaller windmills in them than now, to supply water for household purposes, and for watering the smaller flower and vegetable gardens?

They will supply one or more houses for such purposes, or the larger mills can be erected, jointly, to supply a larger collection of houses.

To again refer to tree planting, I will quote what Mr. Brown of Stirling, Scotland, a practical and scientific forester says: "At the present day the United States are depending upon the wooded regions in Canada for the supply of their useful timbers; and in that country, where so much wood is necessarily consumed for fuel, the supply cannot meet the demand for many years longer; and it is now the opinion of many who are well acquainted with the subject, that in a few years wood will not only be very scarce, but at the same time very dear, — much beyond any price we can form any adequate idea of at the present day."

Consider what these statements contain, and wherein we can profit by these evident facts.

Fuel, lumber, railway sleepers and permanent forests are what must directly result from the encouragement and application of tree planting.

Consider what relation the government bears to this matter. How can it prevent a man from cutting down his woodlands before they are sufficiently matured, or when they surround the source of a water supply; or how can it best insist that municipal or other corporations, which control water supplies, shall preserve or cultivate forests around those sources, so as to protect or increase the quantity and preserve the quality of its waters, which our people are asked to use?

Is it not by *education*, and by spreading that intelligence among our citizens which makes them generally become familiar with the truth in regard to such matters?

Each individual must be educated up to a realization of the value to him, personally and as a citizen, in preserving or cultivating the forests before they can be expected to receive that attention which the case demands.

Travelling through parts of Austria-Hungary, I was greatly interested in the instruction given at the country schools there upon forestry.

Plantations on a small scale were to be found in the school-yards, where the varieties of trees adapted to the district were grown, and in regard to which instruction was given. These yards were partly decorated in this way, and the children grew to have an intelligent interest in their contents.

Flowers, shrubs and hedges also were found in and around these same yards, but not to such an extent as to prevent proper out-door exercise of the children. The instruction and influence of the teachers seemed to follow the pupils out of doors as well as in-doors.

In the plantations of white pine at Middleborough and vicinity, in our own State, had the limbs been kept cut off from the lower part of the trees, instead of being allowed to remain and die upon them to form knots in the wood, I believe those trees would have become far more valuable as lumber, and would have made clear timber suited for the nicer qualities of work. As it was, they were only fit for cheap box-lumber.

They were planted only for the purpose of growing such lumber, and will perfectly well serve that purpose ; but the better lumber can be had by a little more care, and the trimmings can be used for kindlings, etc. In cases where the land will admit, closer planting would partially take the place of removing the limbs by hand.

Cannot the vast number of railroad sleepers that must be supplied prove an inducement to plant trees?

They must be renewed about every eighth year, and the total number required is enormous.

At the West, the railroad companies have planted large tracts of trees to supply, in the future, a portion of their demands.

Plantations judiciously set out and *properly cared for* must command a good price when mature ; and if signs and opinions do not fail, the prices of to-day can be no gauge of the prices in the future.

Increasing scarcity must increase the price of a good article, whether it is clear-grained lumber or a sound railroad sleeper.

A practical method of planting trees over is that recommended by Thomas Milne of Scotland.

He proposes three thousand trees as a desirable number of seedlings for setting on one acre. He uses a planting-iron "about seventeen inches in length, and as it weighs about three pounds, it can be conveniently used with one hand. The planter holds the 'iron' slackly in one hand, and strikes it into the ground with a force sufficient to drive in the blade about three and one-half inches. It is pressed down, and towards the planter; a slight twist given to the right raises the left corner of the sod, and the plant is put in before the tool is withdrawn, care being taken that all the roots are under ground. The 'iron' is then removed, and when the sod sinks back to its place it is struck with the point to break the spring, and the planter, as he steps forward, puts his heel on the cut soil, and so fixes the seedling. By this method plants can be put in among the crevices of rocks, where it would be impossible to place them in any other way. From five hundred to eight hundred plants, according to size, are carried in a bag slung over the shoulder, and hanging down at the back, so as to be within easy reach, and yet not impede the man at his work. Having everything so conveniently arranged, an experienced workman, on good land, can plant from four hundred to five hundred seedlings per hour, or from one to one and a half acres per day." This number depends, of course, upon the character of the soil.

Mr. Milne, like most practical students of forest planting, observes that an increase of forests improves not only the climate, but the productiveness of the farms about them.

It is claimed that we have plenty of woodland in Massachusetts to-day. Yes, such as it is; and we have undoubtedly some fine woodland growth that can safely be called forests. But we ought, for the good of our State and welfare of our population, to have older and far more extensive forests than exist to-day.

Woodlands that are cut over every thirty to forty years are too young to ever be forests in the useful and true sense of that word.

Woodlands that can boast of being sixty to one hundred years old are nearer what we need; and around the sources of our water supplies they should be composed of well-cared-for and old trees. The present age seems to be moving so fast that it may well be asked, What shall we leave for future generations?

The foregoing method for planting is an excellent one to adopt, and the cost of trees and time to be consumed seems reasonable. The cost would be about $22.56 an acre, in return for which there would be the thinnings which must be made as the trees progressed, and eventually there should be a valuable growth of timber.

Some people recommend planting trees eight or ten feet apart each way, which would be cheaper at the start; but the Scotchmen have had large experience in forest planting, which leads me to incline to their plan, as having value in it, although it requires more trees at the start. But this also will depend somewhat on the land.

It is important to consider where we can obtain good trees at prices which will encourage their planting.

There are a few nurserymen in the Western States who grow seedling trees on an extensive scale; notably among these are Robert Douglass & Sons, Waukegan, Ill. And to illustrate how cheaply trees can be bought, I will give an example of prices taken from their catalogue.

Putting the white pine first, as it is certainly a most beautiful and valuable tree in every respect, when well grown, I find it can be bought, of a size suitable for setting out in large plantations, for $75 per 10,000, and $8 per 1,000 trees.

If three thousand trees are set out to the acre over several acres, they would be about four feet apart each way, and cost $22.50 per acre.

If the trees are set out in rows about eight feet apart, and four feet apart in the rows, about fifteen hundred trees would be required at a cost of $12 per acre, unless as many as six and two-thirds acres be planted, when the cost would be $11.25 per acre.

The cost of transportation has not been included in these figures, and the cost of labor must be added.

Still another method of planting has been suggested, which I think has not been extensively tried, if tried at all; namely, to set the trees (white pines, for example) out eight or ten feet apart each way, and then set a Norway spruce, centred between every four pines; the purpose of setting the spruce, with its pyramidal shape, being to prevent the growth of limbs on the pines, and to allow of the spruces being cut down when the pines are sufficiently tall.

The way that I have treated trees, where I have wanted ornamental rather than thick woods, in places much exposed to the winds of winter, has been to buy the trees as seedlings, and set them in nursery rows in spring, and cultivate them, at small expense, for a couple of years, until the roots have developed sufficiently to give them a good start when they have been put in permanent locations.

When I have set such trees out in open land, the whole surface has been plowed the previous autumn; and in spring the trees have been set at the intersection of cross furrows about ten feet apart each way, and I have cultivated them somewhat during the two years since planting. Of the trees so planted I have lost only a very small per cent.

In this way there have been set out about an acre, for what I hope will be eventually a grove of ash trees.

Every other tree each way is either a white ash or an Austrian pine; my belief being that these pines will prove a protection to the young ash trees until they begin to interfere so as to injure one another, when I intend to cut down the pines.

I have also part of an acre planted with hemlocks in a similar way, except that they are planted nearer together, being a more delicate tree, but a very graceful one, especially while young.

A plantation of an acre of European larch trees which were planted about ten years ago with less care, but as then generally recommended, proved a complete disappointment.

In some localities, where the white pine is a native, small seedlings, growing wild, can be secured in large quantities as a gift. This is frequently the case in localities where there is much open land that is too poor for any other purpose than for tree planting; and where such native seedlings can be found, the advantage should be secured.

Tree and shrub planting should be encouraged everywhere. Make homes attractive out of doors, as well as convenient and attractive in-doors; there is nothing that can give more refreshing rest after a day of bodily or mental toil than such surroundings as grow out of a judicious planting of trees and shrubs.

Life in the country is becoming, year by year, more popular among those who now make the cities their homes; and, where circumstances are favorable, it would be well to so prepare the more attractive locations on the farms, by judicious planting and care of trees and shrubbery, that if they tempt an offer, that offer must be a handsome one. Attractions that result from beautiful and extensive views, well-cared-for trees, good roads, fresh milk and vegetables, are among the things which many city people, so called, find can be best secured by life in the country. And do not such people form a good market, and generally good neighbors? When new taxable property comes to our country towns, it would seem to be a welcome addition and aid.

It would be well should people of means oftener establish their more permanent homes in the country, where children could have the full benefit of the exercise that a long season can give. I, of course, have reference to those who are now forced to leave their homes for several months in summer to make much shorter stays at the seaside than would be possible did they seek the country, and enjoy the beauties and interests of springtime and autumn.

Where tree planting is to be done on a large scale, and the other work does not take up too much time to allow of some additional labor, it is better that the seedling trees be reared at home.

The nearer home that the seedlings can be grown, so much less risk will there be in moving, setting out and maturing them.

It is advisable that the soil for a pine nursery be such as shall be cool and moist; but it should be naturally such as to allow no stagnant water to remain on the surface. When the soil has a tendency to be dry in summer, a judicious watering of the grounds is necessary; but this is no obstacle to the establishment of a seedling nursery. Too flat ground, that is liable to retain excessive moisture under or upon the surface, or land that has too great a slope and is consequently liable to be washed by heavy rains or thawing snows, is objectionable, although such lands may have a favorable exposure.

An exposure that is best suited to a fruit orchard would probably be good for a pine or other nursery. Pines seldom suffer from frost, and an easterly exposure is better, with shelter from the west. The rays of the morning sun shining through the cooling atmosphere, and modified by the influence of dew on soil and plants, are always of benefit; but, on the other hand, the heat of our dry summer is hurtful during the long afternoons.

Ground where there will be the least weeds will be best for a nursery, and requires simple care. When a bit of good new woodland can be chosen, and cleared for this purpose, it will prove better, on the same principle that virgin land has advantages for all purposes of cultivation, largely on account of the greater quantity of humus that it contains.

Nurseries should not be established on too poor land, and not on land where any fresh manure, nor even where well-decayed manure, is freshly put on.

Ground game is injurious, and the nursery should be protected where such are liable to occur.

Before it is time to commence sowing, the seeds should be tested; and the following seems a simple method, which must be tried a sufficient length of time before planting to allow of replacing the seeds should they prove poor: —

"Fill a flower-pot, unglazed and of moderate size, with fine earth; sow the seeds, which must be counted, and cover them to the depth of a quarter of an inch; place the pot in an earthenware basin filled with water to a height sufficient to maintain moisture throughout the depth of the earth in which the seed lies, and note the results."

If germination is slow and irregular, the seed is evidently too old.

Where seventy per cent. have sprouted, the result may be considered fairly good; but in parts of France, I believe, seventy-five per cent. is required.

Too thick sowing is a cause of loss, as young trees die under such circumstances; they do not seem to be able to secure enough food for all.

Thin sowing on fresh ground, well prepared, should be the rule to follow; and the word "thin" means not too crowded.

Where a proprietor or private forester with small practical experience establishes a nursery, broadcast sowing of the seed is not advised; but trained nurserymen often find this the better way.

Beds of about one yard wide are probably best, as greater width would be less convenient for sowing, weeding, etc.; and all sowing and care of the beds should be done from the sides only.

When the beds are formed, stretch lines lengthwise of them six inches apart, then with a forked stick or iron having its ends rather sharp, with about two inches between them, draw it along the lines, which will bring the rows of seeds two inches apart.

The seeds are to be dropped one inch apart in the rows and covered lightly with a rake; thus the young plants have plenty of room and light.

The time for sowing in spring is, as a rule, as early as the ground and season will permit of good treatment.

This subject should not be concluded in this brief lecture without reference to forest fires, and there is no part of forestry which is more vital to its success than the prevention and control of forest fires. They can do every year a vast amount of injury, not only to standing wood and young trees, but to fences, buildings, cord-wood, lumber-piles, etc. But one of their greatest and long-lasting injuries is the damage to the ground itself by burning up the vegetable mould, so that no trees can again be made to grow there until this shall in some way be restored by decayed vegetable matter in some form, possibly from the leaves which, in a period of many years, fall from bushes and other low-stunted growth.

Among the causes of forest fires are clearing lands, burning brush, sparks from locomotives, fires carelessly left by persons camping, hunting or fishing; also from the use of improper gun-wads, from tramps and from malice.

It is also said that the friction of dry wood in high winds has set forests on fire, but I doubt whether we have yet in Massachusetts trees of sufficient age to thus commit suicide.

Proper laws, and vigilance on the part of the constituted authorities, will do much in the right direction; and as improvements in laws are required, they will undoubtedly receive due attention.

But the root of the danger lies in the great lack of appreciation of the works of nature, and their usefulness, which is wanting among far too large a per cent. of our population.

I have known of cases where a certain fire department were unwilling to assist in putting out a woodland fire because it was not considered a part of their duty. Of course, the law passed last winter clearly defines such to be a duty, and the aforesaid fire department has since promptly responded under that law.

A more extensive knowledge of the laws governing the growth of animals, trees, plants, etc., would tend to be a great benefit; and it would be wise to introduce into the systems of education more that relates to these useful and interesting branches of study.

The *training* to be so derived must be useful, and we cannot question but that such knowledge, incidental to that training, would prove not only useful but interesting.

It is at home and in the public schools where we can best impress upon children especially the dangers from fires.

Locomotives are being quite generally provided with spark arresters now, which greatly lessen the risks from fires in that direction.

Where they start in woodlands, the best remedy is to plow a line of furrows, when that is possible, around the fire, or to set back-fires.

In setting out plantations of forest trees it is wise to have pathways through them where fires can be fought, by running furrows, starting back-fires, watering, or beating with boughs.

I have found that sprinkling the surface by the aid of a

Johnson pump was of great assistance in preventing the spreading of a fire when it was fought in its early stages, and a small quantity of water went a long way.

Prevention is a far better remedy for forest fires than any other. Seldom do you hear of a person being arrested who starts a forest fire; and it therefore would seem that none but good can come from having on our statute book strict laws for punishing such crimes, with a well systematized fire organization to suppress them when any locality is sufficiently unfortunate as to have need of it.

The law passed last winter for the better protection of forests from fires was what the Legislature thought best to pass, and it seems to have been a very good bill.

Several cases during the past season have shown its value; but there should be a thorough *organization* of the forest fire-wards, authorized under it, to have its value most felt.

That law combines elements that students and writers on the subject have recommended as being essential in any such law.

Some penalty for non-attendance might be a wise addition, but the Legislature probably relied upon a good neighborly instinct to take its place.

The value of birds and the injuries from insects are proper subjects to introduce in this connection and at this place; but time will not allow of my dwelling more upon this subject now.

Suffice it to say that it is for our good to protect all our valuable birds, including the many delightful songsters, when their habits do not warrant their destruction.

The Chairman. There are many suggestions in this valuable paper that ought to give rise to an animated discussion. I am sure you will all be glad to hear from Captain Moore on this subject.

Captain Moore. Mr. Slade, whom we heard with so much pleasure yesterday, says I can tell all about reclaiming land, whether I know it or not. I will commence by saying that I have been pleased with the paper which has been read here to-day. There are a good many thoughts in it that will be of benefit to all of us, if we utilize the ideas that have been presented.

Still there is another phase to the question of reclaiming land with the farmers of Massachusetts. They are men of comparatively small means; when they reclaim land they want to do it in such a way that they can immediately see a return for the money they invest. That is the idea; and, as the chairman has said, I have made some experiments in reclaiming land, for most of the land I have has been reclaimed in one way or another. For instance, I have land that was soft and unproductive that has been reclaimed simply by thoroughly underdraining it. That, with proper fertilization and tillage, has made it good land. I have other land that could not be reclaimed in that way; and to describe it I have got to relate matters that pertain to my own place, which I do not like to do. In front of my house I have one piece of land containing about seventy acres which is very nearly level, and all susceptible of cultivation after being put in proper condition. That land, when I was a boy working on the farm, which my father had bought in different pieces, was, as you might say, almost entirely unproductive. It did not produce *English* hay enough to keep one horse. Being in a good location, it was desirable to make the most of it. What I desire to speak more particularly about is reclaiming bog land, — utterly worthless land in its natural state. I have in the centre of this piece of ground ten acres, which we are reclaiming at the rate of two or three acres a year, at leisure times, and making it productive. This is the course that has been pursued upon that land and its condition ever since I was a boy. It has been mown every year, raked every year, and the surface being soft the crop has been carried to hard land on poles (although it is well enough above water when the ditches are open); still, a horse cannot go on it without rackets. It never paid for mowing, it never paid for raking, and it never paid for taking the hay off. That has been the method practised for the last fifty years, — simply to keep the brush down. That land before it is reclaimed is utterly worthless, — worse than that, because it costs something every year to take care of it. Our work of reclamation is done in the winter. We go over the ground and cut off the bogs or tussocks, and put whatever is taken off in holes, if we can find any. Then there is a sand hill within thirty rods. We put on three inches of sand; and three inches of sand over an acre means not far from four hundred cubic yards. I have figured that as costing me twenty cents a yard. Colonel Wilson tells me that contractors do it for from twelve to fifteen cents, and railroads pay all the way from forty to fifty cents. Of course this is being done at odd jobs; I cannot tell you what every particular cubic yard costs to put it on the land, but I estimate it at about twenty cents per cubic yard. That is a fair estimate, isn't it, Colonel Wilson?

Colonel WILSON. Yes, sir, that is a fair estimate.

Captain MOORE. It is done with my own horses, when they have nothing else to do; the exercise they get at the tip-cart is good for their health. I do not think the horses' labor costs me anything; still, I call it twenty cents for the sand. That gives the cost of putting on the sand $80 an acre.

I don't want you to understand, because I say I have been using fertilizers on this land, that I do not believe in anything else, for I believe in using all the manure I can get, and fertilizers in addition; but this land being on the distant side of the farm, it is more convenient and less expensive to put fertilizers on it than to cart manure. I have applied eight hundred pounds of super-phosphate to the acre, and seeded it down about the first of May. That eight hundred pounds of super-phosphate, delivered on the ground, has cost me $15.20. I have called the labor of putting that on, the cost of seed and harrowing it in, $5. There is nothing to do to the ground, only to slightly harrow it and cover the seed with a brush harrow. I do not use a roller, because mine has given out, and I do not want to borrow, so the seed has been brushed in with a brush harrow. You may think I am telling a big story, but I have cut from an acre of that reclaimed land a ton and a half of hay the first year. I would not call it exactly rowen, but it was pretty good stuff to feed to cattle. There was a ton and a half to the acre, and it was seeded last May.

QUESTION. What kind of phosphate did you use?

Captain MOORE. I am not advertising any particular phosphate. I think last spring it was Bradley's; I used the year before, with the same result, Bowker's. I don't think there is much difference in those two articles, and I presume there are others just as good. I should not try either of them if I could get the crude material. I have called that hay worth $12 a ton standing. If it is cut, there is the labor to be added. I get $18 to $24 a ton for hay in the winter; $6 a ton will pay for harvesting. If I called that crop $18 a ton, I would have to deduct the expense for labor. But calling it worth $12 a ton as it stood there on the ground, that would make the improvements on that land stand me in to-day $82.20. The other pieces that have been treated in the same way for the last three or four years have produced two and a half tons to the acre for the first crop, and a heavy second crop afterwards. I want you to believe me when I tell you that, because it is so. Those pieces have been run with fertilizers from the beginning. No loam has been put upon that land, — nothing but sand, and fertilizers added. I think it will continue as productive for some time to come. I don't know but some of you have seen that land and know the condition of it.

Mr. Bowditch. Do you put fertilizers on every year?

Captain Moore. I put on eight hundred pounds every year.

Mr. Bowditch. Do you use phosphate every year?

Captain Moore. I have on that land, but on my other grass land I have used bone, ashes and muriate of potash as a top-dressing, and I do not consider compost manure an economical dressing, as it costs too much. I raise a few crops, and I raise them as specialties; and grass is one of the specialties. I think that where there are failures in specialties, they come from the bad judgment of the farmer who undertakes to raise on his land a crop not adapted to his soil. I say that the failures in specialties come from a lack of judgment, whereas the man who adopts anything as a specialty is obliged, from the magnitude of what he is doing, to do it in the best way, and to know all about it; and you cannot do that where you follow a system of general farming.

Question. What seed do you use?

Captain MOORE. I use almost entirely herd's grass. I do not use any redtop at all; and I will tell you why. The reason why I do not use it is because I sell my hay in the market, and the purchasers will give me more for herd's grass than they will for redtop; and Dr. Goessmann will tell you that the same plat of ground will produce considerably more weight of herd's grass or timothy than it will of redtop. I want to get all the weight I can.

Mr. TAFT. How much seed to the acre?

Captain MOORE. I put on about two and a half pecks, or twenty quarts. Some other parts of this land that I sowed two years ago with clover has produced three crops this year. I have to mow it pretty early, because it will fall down if I don't cut it.

QUESTION. Is this land underdrained?

Captain MOORE. No, sir; it lies in strips about thirty rods long and one hundred feet wide, divided and surrounded by open ditches. It is not troubled by any surface flowage on it.

I find that the crops on that land, in less than four years, have paid for all the labor and for all the fertilizers, and I have the land left there in such a condition that it would sell for $200 an acre.

Now, gentlemen, I am not going to say to those of you who are situated inland, that it would be desirable for you to lay out as much money on an acre of land as I am laying out on this land to which I refer; but I am nearer a market, and I am warranted in doing it.

There is a piece of that land that has been reclaimed in another way, and I want to have you see the difference. The ground, as I told you, was so soft that we could not put a team on it to plow it; but we did plow it. I cannot tell you how much it cost an acre; but it was slow work, because we plowed it by putting a long rope through a snatch-block, with four horses to pull the plow and another horse to drag the plow back, and two or three men to handle the plow, because it was rough and bad ground to turn over, and that made it pretty expensive plowing. I plowed three or four acres of that sort of land, and it produced a moderate crop; and afterwards, there not being substance enough in the land to hold up a horse, we were obliged to put sand on it, as we had done on other pieces. It is a curious fact that although we had been to all this expense of plowing, this land is not so productive, — will not grow grass as well as the other portion of the land that has not been plowed. Whether it is because we turned up sour material from the bottom, I do not know, but the result shows that on land of that character it is advantageous to put on your sand first. The sand has left that land so that horses can mow it by machinery, rake up the hay, cart it, and do anything of that kind. If you sow your grass seed on that plowed land without the use of sand, what do you find? You find that there is not silicate enough in the stalk to hold it up; it falls down when it is about eighteen inches high; you cannot get any sort of a crop; you cannot do anything with it; it will run back to wild grasses. I do not expect to live long, but I have got about ten acres of that kind of land left yet, and I want to see that under cultivation before I leave. I am doing it pretty fast. Now, that is reclaiming land, and reclaiming it in such a way that you will get some money out of it.

Question. About how near the surface of the land do you keep the water?

Captain Moore. I get it down three or four feet, if I can; but if I have not fall enough to do that, I have to content myself with getting it down two feet. There is a brook runs through my land all the way from two to five feet deep. The land is like a sponge. You cut a drain through it and draw out the water, and when you have lowered the outlet perhaps two feet, you will be astonished to find you have not gained more than eight or ten inches by your digging. Your soil simply settles and compacts by its own weight.

I do not like to take up the time of this meeting, Mr. Chairman, but if any gentleman would like to ask me any questions, I shall be happy to answer them; otherwise, I will give some other person the floor.

Question. Do you prefer sand to gravel?

Captain Moore. Sand is better. You do not want any gravel stones. The late Elias Phinney, who was quite an intimate friend of my father, and who was engaged in reclaiming land at the time my father was, had no sand on his place, and he tried to reclaim some land by using blue gravel. It was not a success. Sand is the material to use, and almost always where you find a peat meadow you will find sand somewhere near. Those are the two extremes.

Mr. Edson of Barnstable. I have been very much pleased with the lecture and with the remarks of the last speaker. What the farmers of New England want is some system by which they can bring their farms to a higher state of fertility. We are farming old, worn-out lands that our fathers and grandfathers have cropped as long as they could get a crop of Indian corn or rye, until they have become worn out. Unfortunately for us, we have got to build them up. Now, the question is, can it be profitably done? I, like Mr. Moore, am modest, and do not like to speak of No. 1, but I do not know how I can get at this matter unless I speak of what I am doing. I hope you will excuse me, therefore, if I bring myself in pretty often. I do it only for the sake of showing others what I have done, and that they can do the same things.

I may state that I was brought up as a farmer, and always liked it; I was afterwards in mercantile business many years, but in 1863 I came back to Cape Cod, my native region, where there is some pretty good land. I took a farm of some seventy acres, and bought the stock and tools upon it, a yoke of oxen, two cows and a horse. The first winter I had to buy hay for my stock. I cut the first season about five tons of miserably poor June grass and weeds, — not enough to keep my stock. Since then I have cut fifty tons of hay upon that place; I have kept thirty head of cattle and four horses and sold hay at the same time. I have done that without commercial fertilizers; I have done it from the resources of the farm. I have made it pay all the time, and I have put the farm in that condition. If I can do it, other men can do it. Now, the question is, how has it been done?

I have made a specialty of making and saving all the manure I possibly could and plowing in green crops at the same time. My mode has been to break up about four acres of mowing every year. The crop that I depend upon for money is hay, principally. I have four fields of four acres each, which is my special mowing land, but I have others that I mow occasionally. On four acres of that I haul the manure for top-dressing. I cannot call it top-dressing in the ordinary way, because it is made of sea-weed, put into the barn cellar and worked over by the hogs; I spread that in the fall. The land is plowed the last of May. The manure has gone down into the sod, and a strong growth of grass is upon it, so heavy that I often have to put a chain on the plow in order to bury it. I harrow the ground and plant corn immediately. It is the Early Canada, which will open in ninety days. That green crop underneath makes the ground like a hot-bed, and it starts the corn right up, a good dark green, and it will grow right rapidly. If it comes on a dry time, that crop does not suffer; the young roots have caught this fertilizer in the sod and have gone down to the green crop underneath, which will furnish a good supply of moisture. The leaves of my corn do not roll, and in the hottest weather, when many of my neighbors are complaining of drought, my corn goes right along. I get from sixty to eighty bushels of shelled corn to the acre.

I would state that I always break up a piece of ground three years in succession in order to get the best results. That clears out all the foul stuff, and gets the land in the right condition to raise a good crop of grass. In August I harrow in rye, a bushel to the acre; in the winter I put my manure upon that rye again, and when I come to plow that land under the last of May it is up three feet and just as thick as it can stand, and worth a good deal as a fertilizer. I turn that under in the same way that I did the grass. I want to state that I am talking of reclaiming waste land, for I call lands that are worn out waste lands. I will state the result of sowing that rye. I turned four milch cows on that four acres, and they got nearly their whole living on the land. I got sixty dollars as the result. Is there any business in this world that will pay better than that? That is the plan I have adopted to bring my lands up from four or five tons of hay on the whole farm to forty or fifty tons. I have made it pay, and I can do it with any other farm. The only way in which we can reclaim these worn-out lands is by saving every particle of everything that will make manure; then utilize the green crops, which you can do without losing a season. Turn in your green crop of grass the first year, and the second year your green crop of rye, without losing any time. I would rather take an old farm anywhere in New England, and have New England surroundings, than to go West and have the best farm given me.

The CHAIRMAN. We have heard how peat land is reclaimed. This is a broad subject, and there are different kinds of soil to be dealt with. The land in Plymouth County is somewhat different from that in Middlesex County, and I think that Mr. Cushman of Lakeville can tell us something that will be of interest in regard to the way it is done in his region.

Mr. CUSHMAN. It seems to me that the ground has been pretty well gone over on this subject. I was particularly pleased with one point brought out in the paper read by the essayist, where he recommended the planting and cultivation of the white pine. I was taught by all the associations of my early childhood to almost reverence the white pine tree, and to-day there is no sight, perhaps, that is more pleasant to me, or upon which I look with more loving eyes, than upon a forest of growing pines. It is beautiful every day in the year. Twenty years ago it was always my delight and my pleasure to recommend the planting of the white pine. I did something in that line myself, but to-day, owing to the change in the relative value of things, perhaps it is not wise policy for the State Board of Agriculture to recommend, or, perhaps, to put it in another form, there is no necessity of urging the planting of more forest trees, and especially the white pine. As has been truly said, my county is the natural home of the white pine, and any one going down to my old town of Middleborough, in the south part of the county, will find there three mills that are annually cutting up large quantities of this lumber. One of the owners told me, not ten days ago, that there would be this year about the usual amount cut up that had been consumed for the last four or five years, 3,500 cords, in one corner of the town. I remarked to him, "Have you any idea, sir, that the annual growth in the vicinity of these three mills is going to supply your mills for any length of time?" He told me he had no apprehensions in that regard, for he believed that the annual growth was fully equal to the annual consumption.

Again, when the farmers were sowing those light, arable fields of Plymouth County with the white pine, and starting those beautiful forests which have been spoken of in former papers by our friend Mr. Slade and others, white pine logs found a ready market at $8.50. They have fallen in price, and find a slow market now-a-days at $7 ; and what the market will be when a forest that is planted this year shall mature, no man living can foretell.

Further, when these forests were planted on those fields, so admirably adapted for the cultivation of Indian corn, there were no fertilizers for the farmers to purchase excepting the manure that was made in that vicinity. To-day, the average farmer who knows what he is about can buy fertilizers adapted to raising crops upon those fields, or any land of that character, with profit. This present season I have cultivated corn upon twelve acres of land of that character which had not been plowed for many years; it had been exhausted, so to speak, of plant food by former owners years ago, in their cultivation of corn and rye ; but with the application of just $15.50 worth of fine-ground bone and muriate of potash I have husked 1,000 baskets of corn from that twelve acres. There was no hand labor until the harvest time. That corn, gentlemen, was raised at a profit. I can and probably shall do the same thing next year with a larger application, hoping with the same labor to receive larger returns. So much for the idea of setting white pine upon land that is adapted to the cultivation of most of our cereals and vegetables. But there is another class of land of a different character, like that described by Captain Moore, which it seems to me is far more important and should claim the farmer's attention. There is hardly a farm in the Commonwealth that has not some waste land of that kind. I never did any more profitable farming in my life, allow me to say, than in reclaiming those waste bogs; and as my elders who have preceded me have taken the liberty to draw from their experience upon their own farms, I trust I shall not be too severely criticised if I follow their example.

Ten years ago, when I purchased the farm upon which I now live, there was a run through it, surrounded by quite high hills, upon the sides of which nothing grew but the coarsest grass, some skunk cabbage, dog-wood and wild grapevines. No creature attempted to go upon that land: it was springy, and there was no chance for pasture. I commenced a system of under-drainage. I was unfortunate in not having any previous knowledge, and I made many mistakes; I paid for what little experience I received with a large price. I have travelled somewhat in different parts of the State, and have seen men attempting to reclaim land of that description who are making similar mistakes to those which I made. The first thing I did was to put on large quantities of sand, thinking that I could in that way overcome the water, — I had not heard our friend Colonel Wilson of Boston lecture upon under-drainage then as much as I have since; but I found that the water would come up as fast as I could put on the sand, and all that labor was lost. Next I determined upon a system of under-drainage; but I was not wise enough to procure the services of a skilled civil engineer, and went to work in my own way, and after laying quite an amount of drain, I found that while the water was taken out of the mud my drainage was not carried off. I had made the same mistake that Captain Moore alluded to this morning, — my outlet was not low enough. I want to emphasize what he said, — perhaps there is no need of it, — but I know that a good many make that mistake of not getting their outlet low enough to begin with. Then I did not have a system of drains in between where I laid my original drains, which is of the utmost importance. I have put them in since, and now I have got them too close. There was an extra expense. Perhaps I am taking too much time upon this point, but I know its importance. It would have been of great value to me if I had had the advice that I am giving to farmers now, — to secure the assistance of a competent and skilful engineer, and get the grades of their drains all right and a proper system of drainage established to commence with. I was obliged in the locality of which

I speak to chop up this ground with a broad axe or cut it with a hoe that was made for that special purpose, turn it with a fork, and leave it until it froze in the winter, when I applied my sand.

It is very important to get a uniform grade, so that there will be no depressions upon such land in which stagnant water can stand. If that is allowed, it will always result in failure and disappointment. The richer grasses will die out and give place to the coarser. Now, I will in just a word say that that land had yielded me, by estimation, two tons and a half of hay at the first crop. I do not mean the first crop after seeding, but after the first year. I seeded in the spring, as Captain Moore has advised. The crop that first year was not half a crop, but I have cut for my first crop two and a half tons, by estimation, and a ton and a half at the second crop, making an annual yield of four tons of hay. I have not applied anything to that land since — and some of it has been in grass five or six years — but an annual application of five hundred pounds to the acre of muriate of potash and fine-ground bone, and you all know about what that has cost me. There are thousands and thousands of acres in the Commonwealth of Massachusetts that could be reclaimed and brought into a state of fertility that would yield four tons of hay to the acre per annum with an annual expense for fertilizers of not exceeding three dollars per ton, or twelve dollars to the acre. Is there any crop the cultivation of which holds out a greater inducement to the farmers of Massachusetts than this? You have not to wait twenty, thirty, or forty years for your crop to mature. You know the value of hay, and you know that you have a ready market as soon as your crop is produced. That is proved by the enormous amount of hay that is annually brought into our State. It seems to me that there is a brighter prospect for the farmer if he will cultivate more of the grasses and produce a larger amount of English hay upon the waste bogs and low lands of the Commonwealth.

The CHAIRMAN. We must now take up another item on the programme. We may resume the consideration of this subject later, for it is a very important one.

SHEEP HUSBANDRY.

BY E. F. BOWDITCH OF FRAMINGHAM.

This branch of agriculture has been an invariable source of profit to the tillers of the soil, as far back as we can get any information. The Bible tells us much about the flocks and herds, describing in some passages quite minutely the ancients' method of tending and caring for their flocks in those old days.

The origin of domestic sheep is wrapped in mystery, but they are generally supposed to be descended from the wild sheep of Asia, which Professor Low describes " as somewhat less in size than the stag, having enormous horns, measuring more than a foot in circumference at the base and from three to four feet in length, triangularly rising from the summit of the head, so as nearly to touch at the root, etc. It has a fur of short hair covering a coat of soft white wool; the color of the fur externally is brown, becoming brownish gray in winter. These sheep are very agile and strong, and move in a zigzag way, stopping to look at their pursuers, like the domestic sheep of to-day."

Of a similar species is the Rocky Mountain sheep of America. It will be of no practical advantage to try to discover how the domestic sheep were descended from their wild ancestors, for we know that in Abel's time there were sheep that were cared for in flocks, very much as in the present day, and in those ancient days there was a demand for wool, besides the skins, for clothing. The lamb business in those days was rather more in the sacrificial line than we look to for profit now. The manufacture of cloth from wool must have begun at a very early date, for it is recorded " that Laban went forth to shear his sheep."

When this country was first settled many kinds of sheep were brought over, without doubt, by the various settlers from the old countries, and from the promiscuous breeding of these, with perhaps a wild cross, we have the so-called native sheep, — a lank, gaunt, slow maturing, short-wooled animal, good for neither wool nor mutton.

Spain seems to have been the first country to improve the quality of their wool (the Spanish sheep date back before the Christian era), and so thoroughly did they study and so practically did they breed and tend their flocks, that they soon became celebrated for their fine fleece, and as their sheep were pastured in winter on the plains of southern Spain and in the spring were driven to the mountain pastures of northern Spain, a distance of about four hundred miles, which took six weeks of driving, they became a very hardy and tough breed, as all those inclined to be weak, died. The fleeces in those days weighed: ram, eight and one-half pounds; ewe, five pounds, which shrank about one-half.

The French merino, imported under royal auspices in about 1786, were very much improved, and their fleeces had increased in weight to: ram, twenty-four pounds; ewe, fourteen.

It would take too long and tax your patience too much to describe the many old-fashioned breeds of sheep that were known in various parts of the world, and I shall only describe briefly a few of the older breeds and speak a little more fully about some of the newer ones before getting to the more practical part of my matter.

Most of the known breeds of sheep in England have, at some time, been brought to this country and experimented with, and we are all more or less familiar with the names of the breeds, and many of us have seen, perhaps, some specimens.

The Forest breeds, so called, are of two kinds, the Exmoor and Dartmoor, which run wild in the west of England, are small, producing a light carcass of high-flavored mutton, weighing only about forty pounds to the carcass.

The Black-faced Heath sheep is a semi-wild breed found in the north of England and in Scotland, very hardy and strong, much prized for its superior high-flavored mutton. It is a very adaptable breed, and very many flocks are fattened on the rich meadows of England.

Where the flocks are exposed to the severity of all the storms, it used to be the custom to smear the whole flock with a mixture of tar and butter (8 to 6) in November, which practice, I have no doubt, kept out a great deal of wet; but I believe that kind of wool was never in very great demand by the manufacturers.

There are still many breeds to be found in the different counties of England, such as Cheviot, Norfolk, Wiltshire, Dorset, etc., but almost all of them show a crossing with one of the Downs.

The long-wooled breeds include the Lincolns, Romney-Marsh, Teeswater, Cotswolds and Leicester. The Lincoln sheep was originally a large, coarse sheep, which found good grazing on the rich pastures of Lincolnshire, clipping a fleece of ten or twelve pounds of wool, long and oily. The breed, as known now, has been crossed with the Leicester, which has made it a smaller sheep, with a lighter fleece, better bodied and with a wonderful capacity for feeding; mutton of this breed sometimes weighing two hundred and fifty pounds to the carcass.

The Romney-Marsh breed (southern coast of Kent) was a similar breed to the Lincolns, but smaller, and has been very extensively crossed with the Leicester.

The Teeswater breed has been lost by crossing with the Leicesters.

The Cotswold is a very old and valuable breed of sheep, and has been a recognized one for about two hundred years. It was first imported into the United States in 1832; this is one of the large breeds, has a long, wavy fleece (clipping about eight pounds); ewes very prolific and good nurses. It has also been crossed with the Leicester, which hastens its early maturing powers.

The old-fashioned Leicester sheep were large, heavy and coarse, slow feeders, and not fit for mutton till over two years old. Thanks to Mr. Bakewell of Distley, Leicestershire, who, by his untiring energy and patience, has made the *new* Leicester one of the mutton breeds of the world, and for a rich pasture and heavy feeding, one of the most profitable; its offal is less to the dead weight than almost any other breed of large sheep that dress one hundred and forty pounds or more to the carcass.

The great drawback to any of the long-wooled breeds for general purposes is their inability to stand the exposure of our cold, wet storms. Their loose, long wool does not shed the water, their skin becomes wet and the animal gets a chill, where the middle or short-wooled breeds would stand a similar exposure with little or no discomfort.

The different varieties of Down sheep are, for us in Massachusetts, perhaps the most useful breeds, as their short fleece makes them able to battle with the storms, and their compact forms and early maturing propensities enable them to get a profitable living on our stony hill pastures, where the larger and heavier breeds would find but a scanty subsistence.

Of all the Downs the Southdown is, perhaps, better known than any of the others, and so strong is its blood and breeding, thanks to Messrs. Ellman & Webb, that it stamps its progeny indelibly, no matter what other blood is used; they are very quiet, and adapt themselves to any sort of treatment or feed. Their lambs mature early, and are so square and plump that they are ready for the butcher whenever they will dress enough to satisfy the demands of the market.

The old-fashioned Shropshire was formerly known as the Morse Common sheep, from the fact that Morse Common (600,000 acres) pastured about 10,000 of them. They then had horns, black or spotted face and legs, and were very hardy and prolific, but not clipping heavy fleeces. A Mr. Meire was the first to improve this breed, which he did by using a Leicester ram; and as the produce became too light in the face and legs, he used a Southdown or some other black-faced ram; and by in-breeding these he brought the type of sheep to what we now see and know as Shropshires, — a fine, square sheep, as handsome and stylish as the Southdown, very much larger, with the same early maturing powers, and clipping a fleece of eight or nine pounds of wool.

The Hampshire Downs owe many of their good qualities to the Southdown, and this breed was made by crossing the Southdown on the old white-faced Hampshire and Wiltshire breeds. Most authorities believe a little Cotswold blood was also used. They have been recognized as a true breed for several years, and are larger than the Shropshire, a little coarser wooled, but as early maturing as any of the Downs, clipping about the same as the Shropshires (8 or 9 pounds).

This breed, as well as the Shrops, are most useful to breed grades from, as they stamp their get in a very marked way.

The Oxford Downs were, originally, a cross of the Hampshire or Southdown ewe and a Cotswold ram. They were not recognized as a breed by the Royal Agricultural Society of England till 1857. Shortly after this date a few were imported into the United States. It is a very useful breed, but a trifle loose-wooled for rough weather; the clip is rather less than either Shropshire or Hampshire, while equal in size to either.

And now having given a rough and very imperfect sketch of the different breeds best known amongst us, let me devote the rest of my time to making you believe in sheep husbandry, and have a practical talk about breeding and raising lambs for the city markets.

Massachusetts has many hundreds of acres of worn-out pasture and deserted farms that would make not only profitable grazing land for sheep, but the sheep, besides getting their living, would clear off an immense amount of bushes and brush, improving the land in a few years enough to make good pasturage for cattle and horses, and increase the actual value of the land.

This used to be a wool-growing State, and in 1845 our clip of wool was over a million pounds, decreasing in 1855 to about four hundred and sixteen thousand. At the end of the war, when wool was high, the clip increased to about six hundred and ten thousand pounds, running down as low as two hundred and seven thousand in 1875; the latter figures would probably be about right for the census of 1885.

The number of sheep in 1865, kept in the State, was 160,997, and in 1875 the number had fallen off to only 58,595.

There is no reason why this State should not again become a wool-growing one, and every reason why it should.

The first outlay for sheep is less than for almost any other kind of live stock, and the returns are much quicker.

For instance, good rugged ewes can be bought for less than four dollars, after they have been shorn and have weaned their lambs in, say, the month of August.

Any farmer that keeps eight or ten cows can keep an equal number of sheep without feeling the expense, except for a little grain to be paid for, which will be more than offset by the money received for the wool, which ought to weigh about five pounds to each sheep, worth on the average $1.25.

The lamb, if an early one and sold to the butcher in April, ought to bring six dollars, and if sired by a thoroughbred Down ram would probably bring a dollar more (seven dollars).

If the lambs are dropped late in the spring, and not ready for the butcher till July or August, four dollars, at least, would be the price.

The ewe, if properly fed, will be worth more than when purchased, and this extra profit, added to the amount received for the wool, will leave the price received for the lamb all profit, unless you want to charge everything into the account, in which case we will take another example.

Take ten ewes for easy reckoning, and we figure out: —

Dr.

To cash paid 10 ewes,	$35 00
" service of Down ram,	10 00
" keep of sheep and lambs till killing, one year,	35 00
Total expense, the manure balancing the labor of feeding,	$80 00

Cr.

By 10 lambs sold, at $5,	$50 00
" cash received for wool, 50 lbs., at 25c.,	12 50
" sale of ewes,	40 00
	$102 50
Deduct first cost of ewes and keep, one year,	80 00
Net profit,	$22 50
Deduct 50 per cent for accidents, etc.,	11 25
	$11 25

Or about fourteen per cent. on first cost, and all expenses for one year. This is in case you desire to sell your ewes at the end of the year. If you decide to keep on breeding sheep, the account looks even better, for your ewes (or capital invested) are worth more than when purchased.

You invested $35 for the sheep, and the total outlay for feed, etc., has been as before, $45, — making total outlay as before, $80.

Your income from this investment of $35 amounts to $62.50, or, deducting the total expenses for the year of $45, you have left as profit $17.50; and after deducting one-half, $8.75, for accidents as before, you have left a net income of $8.75 on your capital of $35, or a dividend of 25 per cent., which, in these days of cheap money, might be called a *fairly* profitable investment.

I am so anxious to do all in my power to bring about sheep-raising in this State again, that at the risk of making myself tiresome and tedious I propose to give you a few practical suggestions.

The first excuse given for not keeping sheep is *dogs*.

I grant dogs are a nuisance when you want to raise sheep, and so they are when you want to raise chickens, ducks or any of the smaller barnyard live stock; but we now have a dog law that is pretty good, — not quite as good as we could wish for, but still good enough to cover all risks, if a man really wants to keep sheep.

You do not give up raising chickens, etc , on account of trouble from dogs; then apply the same rule for sheep, — namely, keep enough sheep in each town and village in this Commonwealth to give the dogs a liberal education. They will soon learn. As it is now, sheep are so seldom seen, that dogs think they ought to be put out of the way, as a nuisance, as much as if they were wild beasts or vermin.

Of course there are some dogs that are naturally bad, as there are some bad boys. Do with the dogs as we sometimes want to do with the boys, — kill them, and plant them four feet under ground.

I would suggest, as soon as you buy any sheep, to dip them in one of the various preparations to be found in the market to kill ticks and cure scab. Repeat the dipping in seven or eight days, and you will destroy everything in the way of vermin that might have been in the egg state at the first dipping.

If you start with a flock of sheep free from ticks or skin disease, it is very easy to keep them clean; but if you allow either ticks or scab a little start, you will find it a hard race to get ahead.

Bells on the necks of sheep are a great advantage, for several reasons. If the sheep get out of the pasture, you can find them easily; if a dog gets among them with the idea of chasing them, the ringing of the bells very often will disconcert him and stop him; besides, the noise of the bells made by the sheep, when frightened, is very sure to be heard by some one on the farm, unless the pasture is a long way off.

Use hurdles to yard your sheep in at night, and yard them every night. The advantages are these: if you hurdle in a pasture, you can hurdle on the poorest spots, and in this way top-dress them, so that it will show for many years. If you hurdle on your mowing fields, the same advantage holds good.

Feed a little grain in troughs, in either case, and take my word for it, you will top-dress your pastures and fields cheaper than you ever did before, and you will get no foul seed on them by using this kind of top-dressing.

The time and labor needed is in changing the hurdles every two or three days, or when you have got on as much manure as you desire.

If you want to raise early lambs, the hurdling will be almost indispensable, as you can then put your ram in at night, and by feeding him all the grain he will eat during the day you will have him fresh for service when turned in with the ewes at night.

A word about breeding for early lambs. The great trouble to overcome is, that the ewes refuse to receive the attentions of the ram as early as desired. By feeding a little more grain than usual, you make the ewes gain a little flesh. This helps; the old English saying, "A ewe comes rutting when she begins to mend," is also true with us to a certain extent.

But from my own experience, I believe that more than feed, or even frosty nights, is to have rams enough to turn out a fresh one every night, and then, by using other rams in regular succession, give each a few days' rest. When each one's turn comes to be put with the ewes, he is full of life and desire, and teases the whole flock over and over again, till at last the ewes begin to yield to his entreaties.

Using rams in this way, there ought to be a ram for every fifty or sixty ewes; but if used more carefully and not allowed to exhaust himself by constant teasing, thrice the number of ewes can be covered in a season by a mature ram in good condition and constantly well fed. Oats are the best feed for a ram while in active service.

Do not not keep your sheep out too late in the autumn, and expect them to do as well as they ought.

Frozen grass is no better for sheep than for other kinds of stock.

Take your sheep from pasture when you house the rest of your animals; but remember sheep cannot have their shed too cold for comfort and health, if it be dry and afford shelter in case of wet weather.

A sheep with its warm fleece laughs at zero weather, and, if allowed to choose, will lie out on the ice in an open yard, in preference to a warm, well-littered shed, if the weather be fair and not too windy.

Here let me add that it is impossible to keep a flock of sheep in a healthy, thrifty condition, unless you so arrange the sheds as to control the ventilation and have a good supply of fresh air at all times. A good-sized sheep ought to be allowed at least ten feet in the shed and two feet at the feeding rack; the larger the yard for exercise the better.

Running water is almost indispensable, and you will hardly believe me when I tell you that, in spite of the old belief that sheep do not need or even care for water where there is plenty of snow to eat, I have known a flock of breeding ewes to drink by measure over four quarts of water each per day, besides eating more or less snow.

Sheep are naturally fond of browsing on all sorts of bushes and foul growth when at pasture, and so in winter they can be kept on meadow hay and all kinds of second-class fodder, that could not with propriety be fed to milch cows, and would be entirely unfit for horses. This sort of fodder they really seem to prefer, and with a small ration of grain every day a flock can be kept thrifty and "on the mend" at very little expense.

In raising lambs for early market you will need a pen for the ewes to *lamb* in, that can be shut up warm, or rather can be kept above the freezing point, for it is generally decided within the first half hour of its birth whether the lamb is to live or die. As soon as the lamb is born, if not able to suck for itself at once, milk some of its mother's milk into its mouth without delay, and if the lamb is naturally strong and healthy, and the ewe a decent mother, there will be very little trouble in raising it.

Do not, from mistaken kindness, keep your lamb in a warm pen more than a day or two, as nature has provided a very warm lamb's-wool jacket, and thus clothed it enjoys jumping about on the ice and snow as much as its dam, and will grow faster and be ready for market earlier than if kept close or forced under glass. The lamb for early market must be forced along with all it can be made to eat, besides feeding its dam on the kind of food requisite to give the greatest possible flow of milk.

Arrange a little rack and trough in a corner of the shed, fenced off in such a way that the lambs can run in and out freely, but which will keep out the ewes; in the rack keep the best of early cut rowen, and in the trough, grain.

The first lambs are sometimes slow in learning to eat, particularly if their dams are large milkers; but after they once begin to eat, the younger ones soon follow their example. Bran seems to be the kind of grain a lamb prefers at first to any other kind, and for that reason it is easier to begin with it and gradually substitute other kinds of grain, until your lambing has fairly begun; and then my advice is, to use for lambs intended for market and to be ready as soon as possible, a mixture of finely ground corn meal with enough old process oil meal added to keep their bowels in the proper condition. Should the lambs show signs of constipation add more oil meal, and if they begin to scour, lessen the quantity of oil meal; the proper proportions for the mixture are from one-fourth to one-third oil meal. The amount of grain lambs can eat and digest is perfectly amazing, but the more they will eat the sooner they can be killed for the market; and if they want a quart and a pint a day at thirty days old, they must have it. I do not believe a lamb will or can eat enough of the above-described mixture to hurt it or to produce a fit. With all other mixtures I have tried, while I have raised some good lambs and had them ready for market at a very early age, I never got through the season without losing a few from fits. This last season, out of about one hundred and seventy-five lambs, not one was made sick.

Be regular in your feeding, and let nothing disturb your ewes and lambs; only those persons that the sheep know should be allowed to go among them. A shepherd's crook is a great help in catching lambs, as the whole flock can be crowded into a corner, and by slipping the crook on the hind leg of the lamb sought for, the rest of the flock are but very little disturbed.

The younger the lamb can be made to dress twenty-five to twenty-eight pounds, the more the profit. Lamb, to be at its best for table purposes, should be under sixty days old, and if you can have them heavy enough when forty or forty-five days old, the meat will be much more tender.

The sooner the lambs can be dressed after they are separated from their dams the better, as they begin to fret and worry at once; and if kept in this condition for twenty-four hours without food, as they must be if sent quite a distance, the meat loses much of its fine, sweet flavor, because the lambs are in a more or less feverish condition. There is a right and a wrong way of dressing sheep and lambs, and I am sorry to say the wrong way is the one generally adopted.

Sheep offal has a peculiar and very disagreeable odor, which impregnates the meat if allowed to remain many minutes after death. The peculiar taste we have all noticed in mutton, and for want of a better name we call "muttony," is caused by this, and not, as many people believe, by the breed or feeding. The reason that this taste is so frequent is, that all the sheep killed in large numbers are dressed by the butchers at so much per head, and in order to work quickly the butcher or his assistant cuts the throats of several at once, and then begins dressing them. The first two or three are hung up in a few moments, but if six or eight were killed at once, some of the last ones will have become impregnated with this offal flavor, and are very different to the taste when cooked than if they had been dressed at once.

No one can tell the difference by the eye or nose, but you discover it very quickly when the mutton is cooked and you taste it. It is not so marked in lamb as in mutton, but enough so to warrant dressing the lamb in as short a time as possible.

Mr. B. W. Potter of Worcester. I have considerable land on my farm that needs reclaiming, and I had thought of saying something about the reclamation of land, but so many have wished to speak upon that subject that I have not found an opportunity. I desire to say a word or two in reference to the essay that has been read, inasmuch as I have had a little experience in sheep culture, and if I had heard this interesting and instructive address before I began my experiments perhaps I should have come out better; but I want to call your attention to one thing which he has not mentioned. He says that one of the troubles connected with sheep culture is dogs, but there is another trouble in this part of the State which I think is a more important matter than the dog question, and that is the inability to keep sheep anywhere where they ought to be in the pastures. A few years ago I found that my pasture was growing up to brush and brambles, and I thought I would see if I could not devise some way to make it better; and, after reading up on the matter, I came to the conclusion that the way to do it was to go into sheep husbandry. I thought if I got twenty-five or thirty sheep and put them in the pasture I could reclaim it. I read everything I could find on the subject, and I thought I could put twenty-five or thirty sheep into that pasture and keep them there without diminishing the number of cows that I had there, and I also persuaded myself that I could sell early lambs, and that every part of the sheep would work up into something of value; that the mutton would sell, the pelts would sell, and there would be a great deal of profit in it. So I arranged my stable for sheep, and there being nothing but a stone wall around the pasture, I got barbed wire and put a strand over the wall, and bought twenty-five or thirty sheep, — Cotswolds, and some Southdowns; and I went so far as to speak to Secretary Russell about one of his high-bred rams. I got those sheep and put them in my pasture, and I remember the satisfaction I felt when I went out on a hill where I could overlook this pasture and thought to myself, "It will not be long before those bushes and brambles will disappear, and in the place thereof will be growing sweet and nutritious grasses." I thought it would be a profitable operation. I believed I was going to "kill two birds with one stone," — that I was going to renovate my pasture and make a little money at the same time. It went along a little while, when the dogs came and killed one or two of the sheep and frightened the rest so much that I soon found they were in the habit of running over at least two towns. It was impossible to keep them anywhere. They did not show any inclination to stay in the pasture. As there were a hundred acres of corn in the neighborhood, I went to work and put another strand of barbed wire around the pasture, and thought that would surely keep them there, but they had got into the habit of jumping, and their long wool protected them so that they did not seem to feel the barbs, and in a little while the wire on the top of that fence looked like an out-door wool-carding machine. They were so troublesome that the second year I put them into the Worcester market; and, for aught I know, they are still jumping somewhere else in the universe in some other form of existence. But, notwithstanding that, I sold the lambs and the wool — having good luck in selling the wool — for enough to get me out of the scrape without any particular loss except the expense of the fence. I think they improved my pasture very much, notwithstanding they did not stay there more than half the time. I thought, when I got rid of them, I would get a less unruly breed of sheep, and probably they would stay there, and I should not have any trouble; but I have had such peaceable and quiet times since, I have not done it. I think, when I try it again, I shall go down to Framingham for quiet sheep that will stay in the pasture. But any ordinary farmer up here, who has nothing but a stone wall around his pasture, if he undertakes to keep sheep, will find that he has got into trouble, unless he has succeeded in getting a quiet breed of sheep.

Then there is another thing to which the essayist has alluded which I desire to emphasize a little, and that is the value of sheep manure. I think it is the best of all kinds of manure, and barnyard manure is the best of all fertilizers. Good commercial fertilizers are very useful when properly applied, but barnyard manure, and especially sheep manure, will show its good effects for many years. About twenty-five years ago I left my parents' home for the purpose of trying to make my way in the world, and just before I left, an old barn that stood in a field near my father's house, where a man had kept sheep in the winter, was burned down. A year ago last fall, when I went back to revisit the scenes of my childhood, I found the old house standing there as of yore, humble, yet beautiful to me. I looked again upon the orchard in front of the house and upon the green meadows and pastures around; I trod once more the old familiar playgrounds; I slaked my thirst at the everflowing spring on the hillside, and I found that what was left of the old barn had been removed, and there the aftermath was growing ankle deep, in strange contrast with the grass in the rest of the field. I found upon inquiry that the man who had lived there when I left was still the owner of that field. I sought him out. I found he was the same simple countryman that he was when he gave me apples and cherries in my youthful days. He had grown old with the wear and tear of life, his hair was white, and as he talked with me about the old times he seemed to be looking into futurity, and I fancied he could almost see the "river of the water of life" in the eternal world. After some conversation with him, in which he reminded me of many boyish pranks, I asked him how it was that the grass in that part of the field where the old barn used to stand was so much better than the rest of the field. He said: "That old barn was where I kept my sheep in winter, and from that field I have taken a crop of grain or hay every year since the barn was removed. I have manured the other parts of the field, but I have never put any on this place, because it seemed to be rich enough without it." That was twenty-five years, a quarter of a century ago; but that sheep manure has kept that soil productive. I may be wrong in my opinion, but I believe if I should go back there twenty-five years from to-day I should still see the good effects of that sheep manure around that barn.

Perhaps other barnyard manure would do as well, but I doubt it.

Mr. MOORE of New Braintree. I have been very much interested in this essay. Sheep husbandry is something that is valuable to us, I believe, in more ways than one, and the principal drawback seems to be lack of protection from dogs, — the fact that our sheep are cleaned out, we might say, by dogs. Mr. Bowditch has spoken of the hurdle, and I suppose he has a model of it there. I wish he would explain to us something about the cost of making it, the number of sheep which it is good practice to enclose together in hurdles, and if it is a thorough protection in the night-time from dogs.

Mr. BOWDITCH. I do not know how perfect a protection it is from dogs, but we have kept from fifty to three hundren sheep and hurdled them every night during the season for the last five or six years. We have never had a dog get through the hurdles. Whether they have ever tried it or not I can't say, but I have never had my sheep worried. Hurdles cost about forty cents a length. You merely take common fence pickets, which always come four feet long, and two by three inch scantling for the rails.

QUESTION. How many lengths are required to enclose say fifty sheep.

Mr. BOWDITCH. It depends entirely upon what you want to do. At night they will stand very close hurdling. It is according as you want to accomplish the work on your land or pasture. Where you want to crop it and kill the bushes, the smaller the hurdle the better, because they will trample it so continuously that they will kill the underbrush and enrich the bushes so much they will die; but if you want the manure as top-dressing for a mowing field, it would be better to have a larger hurdle, so that the dressing will be scattered over a wider space.

QUESTION. Is there any difficulty in getting them into the hurdle?

Mr. BOWDITCH. No, sir. The moment the man comes in sight to put the grain in the troughs, if the sheep are in the field where they can see him, they will come at once and crowd in.

Question. What kind of a fence do you use?

Mr. Bowditch. If you don't look out when you are buying sheep you will get jumpers. You want to be as careful not to buy jumping sheep as you would be not to buy a kicking cow. I have had some first-class jumpers, but I do not like them. In using barbed wire you want to put it on carefully, and notice exactly how your sheep go at a wall. You want to put the barbed wire so that the barbs will prick their noses. At one time I had some forty jumpers. I put a barb wire on top of the wall, and they had some very sore noses for a day or two, but it kept them in. They will jump an eight-foot wall if they can only get a foothold. I put the barbed wire about three inches above the top of the wall, so that when they put their feet on a stone to jump, the barbs would prick their noses.

Question. Have you put cattle and sheep in the same pasture?

Mr. Bowditch. I have, occasionally. I think the sheep do very well, but I don't think the cattle do quite so well, because sheep feed so close. A pasture which I had of some forty acres, which carried from early May until September 290 odd sheep, when I began to put sheep on it five years ago would keep alive seven cows, — it would not give them enough to eat. I see no reason, from the experience I have had, why any number of sheep cannot be kept together if they are healthy and watched carefully, provided you give them proper ventilation when you house them, for there is no animal that needs fresh air as much as sheep.

I think the best grain for sheep is a mixture of corn meal, ground oats and shorts. I would say that in the summer time I feed a very small amount of cotton seed, — just a bare pinch. That is a highly concentrated food, and I would not feed much cotton seed after the ewes are fairly with lambs. I have had some trouble in using it.

Question. Would you feed cotton seed to lambs?

Mr. Bowditch. No, not unless I wanted to have them die before I was ready.

Question. I would like to ask Mr. Bowditch if a small flock of sheep could be profitably kept on a garden farm to eat up the waste of the crops?

Mr. Bowditch. If they could be hurdled close by your garden, I don't see why not. You can feed them anything in the way of rubbish, such as turnip tops, old cabbages, or anything of that sort.

Secretary Russell. I wish to speak in regard to the protection which sheep owners have under the law. As you all know, who have heard me at the institutes for the last seven years, I have continually advocated sheep husbandry; and I remember to have said six years ago, in my first season before the institutes, that if I was secretary of the Board of Agriculture for four years, and there were not four times as many sheep in the Commonwealth as at the time of speaking, I should consider that I had lived in vain. Well, gentlemen, I have lived in vain, so far as that part of my duty is concerned. There are fewer sheep now in the Commonwealth than there were five or six years ago, notwithstanding we have kept this matter continually before the agricultural community at the institutes all over the State; and the continued complaint of the farmers in regard to the matter is that they are not sufficiently protected by the law in this most ancient and valuable of all husbandry. There are a few here who have had practical experience; and practical experience bears out all that you have heard to-day from Mr. Bowditch, and bears out all the records of the past which have been so strongly in favor of sheep husbandry in every part of the world.

In regard to this matter of sheep and dogs, — this "irrepressible conflict," — it is not any greater here than it has been in every other part of the world where sheep and dogs have been kept together; and men, notwithstanding, have been enabled to maintain their sheep husbandry. Mr. Bowditch's essay indicates a great deal of Bible learning, which was noticed especially by Captain Moore. The captain said he could correct him on some points that he made, having brought his Concordance with him; but I don't believe it. You will find that there are constant references in the Bible to the ravages of dogs, and to the injuries that the husbandmen in the early days suffered from them. We here are no worse off than men have been in every other part of the world.

But, before I speak in regard to the law, I wish to emphasize what Mr. Bowditch said in regard to sheep and dogs becoming acquainted with one another. A dog, quicker than any other creature in the world, can be taught what his master wants, and to respect what he knows is property. A dog likes to protect your property rather than to destroy it; and the reason that our isolated and small flocks of sheep are attacked and destroyed by dogs is not so much the inherent viciousness in the dogs, but the fact that the dog does not distinguish that creature as one of the domestic animals which is the associate of man, on a par with himself, and to be treated as farm stock. I fully believe this. I have had some hard experience in this regard. Ignorant or inexperienced dogs will sometimes attack calves. I remember an instance on my place. A dog that I had raised and kindly nurtured until he had grown to weigh about 140 pounds, one day suddenly saw a calf, — perhaps the first he had ever seen, he being about a year old. I heard a noise, and on looking out saw the calf and dog tumbling upon the ground. I immediately took part myself in the conflict, and the result of it was that the next time that dog saw a calf he came up to me, and, looking in my face with a confidential expression, manifested to me his profound conviction that he would never touch another calf as long as he lived. I had no trouble in teaching him that. Every man who has raised a pup upon his farm knows that he is liable to lose a chicken or two until he catches the dog in the act, and then and there convinces him that a chicken is something to be respected and taken care of instead of being destroyed. We want to keep sheep so that the dogs will get acquainted with them; for people will keep dogs. There is no use in farmers complaining that their neighbors keep dogs. Dogs are kept all over the world, and they are going to be kept. You cannot get a stronger law than we have now; and if you should succeed in getting a law ahead of public opinion, it would be of no use. When you go to the Legislature you find two or three hundred men who are interested, not in sheep, but in dogs. There is not a single man in the Legislature, perhaps, who has the slightest interest in sheep; while three-quarters have a direct interest in dogs, either their own or that of their families. They sympathize with the dog against the sheep. Law is not made to prevent crime; we can only make laws to punish, and the fear of punishment must act as a preventive. All we can do in this case is to have a law that will pay a man the damages that he suffers in his sheep husbandry. We have such a law at the present time. It is a good law, and it is very easy of application. I have used it practically. I have had my sheep killed to an extent that would perhaps foot up more than $400 in two years' time, and I could have got six or seven hundred dollars if I had asked for the full measure of the law as applied to my flock, but I asked merely the precise value of the sheep that were killed and found on the ground; and I assure any man who wishes to keep sheep, that although I cannot guarantee him against the distress of having his flock injured by dogs, I can guarantee that the money damage will be fully paid back to him.

Mr. West of South Hadley. There is one thing that the farmers who have lost sheep cannot convince the County Commissioners of, and that is, that they are entitled to compensation, not only for the sheep killed, but for the worry caused to the other sheep.

Mr. Bowditch. The selectmen are bound to employ an expert, and if they bring on somebody who is not an expert you can compel them to get one.

Mr. Houghton of Sutton. We have three flocks of sheep in our town, and their owners expect every year to lose more or less by dogs. One man told me that his dogs could not be made to touch a sheep. He took them up there, and they killed a sheep before my eyes.

Major Alvord. I am a believer in keeping a few sheep on every farm. The first thing I asked of the farm committee when I went to the college this fall was that they would get a few sheep; and we have a small flock, which I think can be made profitable and sometimes instructive. I do not believe they are going to be materially injured by dogs while under our charge. If we turn sheep out where we do not expect to see them more than once a month, we may very naturally expect a few losses; but for the past five years I have handled from one to three hundred sheep, and during that time I have had but one visitation from dogs, although that was the only flock of sheep within five or six miles. They were always hurdled from before dusk until after sunrise, and the only time they were attacked by dogs was in the middle of the day, when they at once ran to their open hurdle, which was quite small, and when once in a compact body in the hurdle the dogs did not molest them. Only one or two lambs were left out, and they were killed.

The main thing I wished to say was in regard to the breeds of sheep. Although we have our favorites, of course, and there are advocates of all the various breeds, when it comes to a public test, they turn out very nearly equal in the country at large. Probably the best actual test or competition between the breeds is at the fat stock show at Chicago.

I have watched for two years to see if there was any uniformity in the awards of prizes for the best animals in the sheep department, either alive or dressed, and I observed that the sweepstakes for the best fat wether was awarded last year to an Oxford Down; that the next prize went to a Cotswold, and the third to a Southdown; but when it came to the carcass prizes, neither of those three took the first prize, but it went to a Shropshire. Although a Southdown also took a premium for the best carcass, — the largest percentage of edible meat, — that was the only case in which a breed which had been awarded a prize alive was given a premium after dressing. This year the first premium for fat sheep went to a Hampshire Down. That animal, however, was not noticed in the carcass class, but the prize for the best carcass went to a Southdown. Comparing these two years with the record for several years before, I find that the prizes were about equally distributed, which indicates that the breeds of the most careful breeders and feeders work just about alike in taking on.

The Chairman. I have understood that they keep sheep in Franklin County. There is more than one man here from that county. We have not yet heard from Mr. Grinnell. It strikes me that he knows almost as much about sheep as the Secretary does.

Mr. Grinnell. The little I know about sheep I have told in reports to this Board of Agriculture two or three times; it is an old story, and to me it is a very painful one. The attempt that so many of us make to induce the farmers of this State to engage in sheep husbandry is constantly met by the answer, "We cannot do it on account of the destruction by dogs." It has been said here, and said truly, that the Legislature is composed of dog owners, or dog lovers, rather than those in favor of the sheep industry of the country. One attending a farmers' meeting or a meeting of this Board, and seeing the expression on the faces of those present, would suppose that dogs were in disfavor and that sheep were the favorites; but it is very different when you go to the polls. Then you do not think of that, but you choose a man who keeps a dog and disregards sheep. You take a lawyer or a shopkeeper, who is not connected in any way with agriculture, and send him down to Boston to make your laws. That is what is the matter, and that was the difficulty when, three or four years ago, we submitted amendments to the dog law which no reasonable being could object to. It was passed in one branch of the Legislature, but in the other it was killed by a dog owner, a dog breeder and a lawyer to boot, in the city of Boston. (Applause).

Secretary RUSSELL. He has run away since that time.

Mr. GRINNELL. I know it perfectly well, and I only wish he had left no successor. Every man who speaks on this subject tries to excuse and apologize for the dog. We have had two or three here to day, — shining lights. They are dog owners, and think more of their dogs than they do of their sheep.

Secretary RUSSELL. Do you mean me?

Mr. GRINNELL. Yes, sir, I mean you.

Mr. BOWDTITCH. I will guarantee that I keep more dogs on my place than any other man here, but still I keep sheep with them. I say that we can keep sheep and still keep dogs, and any man who wants to keep sheep is a weak-backed brother if he cannot keep them in spite of dogs. For the last five or six years I have kept sheep, and there have been five or six hundred dollars' worth of sheep, at least, killed within half a mile of me. That did not frighten me at all. I buried the dog that attacked my sheep; the other men hadn't pluck enough to do it. It is very easy to keep sheep if you want to; if you don't, it is very easy to make excuses.

Mr. Grinnell. There is one class of farmers who do a great deal of good and for whom I have great respect and affection. They are farmers of means, and can keep any amount of help they want about their farms. They tell you to get a steam engine and pump, or to get a windmill, and irrigate your land. You are also told to hurdle your sheep. But where do the farmers in the western part of the State pasture their sheep? They are not in the orchard near the house, they are not within a half a mile or a mile, perhaps not within three miles of the house.

The majority of our sheep, as Mr. Taft says, are pastured three miles off. It is impracticable, not to say impossible, to hurdle those sheep. I know it is a very excellent system, if you can do it and have the conveniences for doing it; but what man is going off three miles to hurdle his sheep when he is perhaps getting in his hay? It is impracticable for us who are living out in the country, and while a most excellent and valuable plan on such a place as the one where Mr. Bodwitch lives, where he has a beautiful house, from which he can watch the pastures, and if there is a dog in sight send out his men and hurdle his sheep. Then he keeps so many dogs that the others keep off. His mastiffs are a great protection. I have a great respect for a mastiff—when he is on the other side of the fence! (Laughter.) It is unfortunate that we are debarred from this most pleasant and profitable occupation of raising sheep. The number of sheep in this Commonwealth has been constantly decreasing for the past twenty-five years, and the reason undoubtedly is because of the ravages of dogs. The Secretary says that we have got law enough, and yet the sentiment of the farmers of this State is, that they cannot raise sheep because of the dogs.

Secretary Russell. I said we have got all the law we can get. All the law you can get ought to be enough.

Mr. Grinnell. We have got all we can get, perhaps, but we ought to try to get more. I should like to see a Legislature of sheep owners.

Mr. MOORE of New Braintree. I do not know but we have got all the law we can get, but we have laws that compel us to keep our cattle on our own premises, and if dogs are property, if they are farm stock, why should not their owners keep them on their own premises? Give us a law that will do that. If they are kept on the premises of the owner, unless the owner or some one is with them, then our sheep are safe; we can raise sheep, and it will be an industry worth having in Massachusetts.

Secretary RUSSELL. I have been intrusted by the Board of Agriculture for seven years with the advocacy of whatever they wanted to obtain from the Legislature, and I have found out to my satisfaction one thing, that you have to go before legislatures with propositions that they will grant. There is no use going before the Legislature year after year and pleading, as I have done, for laws that do not meet the views of the men who are asked to make them. They will report against you, and will not allow your proposition to go before the House or Senate; or, if it goes before the House or Senate, you will be ignominiously defeated there. Mr. Potter, who has spoken here this morning, was Chairman of the Committee on Agriculture three years ago, I think, and we got through him some matters before the Legislature that were very important to the farmers, and they were ably advocated upon the floor of the House, but when presented in the Senate we were defeated. Mr. Grinnell says I said we have got law enough. I said, we have got all the law we can get. You cannot induce our Legislature to make a law putting dogs under the same restrictions as other domestic animals. We have tried it over and over again. As the law stands now, I think it is fairly constituted, and it pays us all the damages, at least, that we suffer. As to Mr. West's complaint that he cannot get from the County Commissioners —

Mr. WEST. No, sir, I did not say I could not; I say that is the trouble in some parts of the Commonwealth. I don't say it is the trouble with me; I always get all I ask.

Secretary RUSSELL. You get all you ask, I get all I ask, and other men get all they ask, so that your complaint is not well founded.

Mr. West. I say that is the trouble in the Commonwealth.

Secretary Russell. I have found that the Selectmen were on my side and on the side of the sheep when I have called upon them.

Mr. Taft. That is true in our county.

Secretary Russell. Not only that, but I have found that the Commissioners of Worcester County, whenever a matter of this kind has been brought before them for adjustment, were on the side of the sheep. If a man is dissatisfied with the award of the Selectmen he may appeal to the County Commissioners. I might have got more money than I did if I had made such appeal. I think there is no inclination on the part of any of the public authorities to oppress the farmers in this respect.

Adjourned to 1.30.

Afternoon Session.

The meeting was called to order at 1.30, Mr. Goddard in the chair. The first speaker of the afternoon was Mr. M. W. Bartlett of West Newbury, who read the following paper on the Influence of Agriculture on Climate: —

INFLUENCE OF AGRICULTURE ON CLIMATE.

BY M. W. BARTLETT OF WEST NEWBURY.

According to the best lights we can get in regard to the creation, this fair earth of ours has not always been "in verdure clad." By the description given in Genesis we learn that it was not until the third day that the grass and herb yielding seed and fruit tree yielding fruit were brought forth, and "earth smiled in all its vast attire."

So far as the *order* of the six days' work of the creation is concerned, the Mosaic account is confirmed by modern science. By its light we go in geologic ages to a period anterior to the creation of animal or vegetable life on this earth, — to a time, indeed, in which so great was the heat on its surface that *any* organic life was impossible; and that it was only after many ages had elapsed, — so many, indeed, as to be entirely beyond finite comprehension,— that it was fitted to sustain a few of those lower forms of organic life that were capable of enduring a super-tropical climate; and that even after those lower forms of life were created, still other geologic ages must have elapsed, each of which may be modestly estimated at millions of years, before the climate and soil were fitted for the higher forms of organic life, and finally for man.

And now, after the great forces of nature, light, heat, frost, gravitation, electricity, winds and waves, ocean currents and earthquakes, have been operating for countless ages to make this earth the beautiful and fruitful abode of the human family, is it possible that, by human agency, in a comparatively short period it can be shorn of its beauty and fertility, or its climate so changed as to render it unfit for man's abode? Can man by his works affect in any appreciable degree the "mad, untamed elements that set on fire the heavens with falling thunderbolts and drench the earth with floods"? is the subject for consideration this afternoon.

In discussing the climatic influence of agriculture, the destruction of forests and irrigation will be considered, as well as the cultivation of the ordinary field crops.

We suppose it to be an indisputable fact that a large extent of the earth's surface now a desolate and barren desert was once clothed in the beauty of a luxuriant vegetation. No mighty cities could ever have had an existence on the shifting sands that now almost conceal the sites of the once proud capitals of those great empires, Assyria and Babylonia. Their wealth and magnitude and glory, like that of all other great cities, must have depended on a soil that within no great distance yielded to the cultivator wholesome fruits and grains in liberal supply. But where once stood that mighty city with its walls, hanging gardens and temples, Babylon, the wonder of the world, and that other city, little less in its glory and renown, Nineveh, now desolation reigns supreme. Such is its barrenness that no village of more than a few hundreds of miserable dwellings can be found in the whole region.

In Egypt a similar condition has been reached. The valley of the Nile, so far as its annual inundations have enriched the soil, has continued in a state of unrivalled fertility; but beyond this, all is barrenness. As Whittier says, "The sphinxes question the centuries from their veils of sand;" and as a noted traveller says, in speaking of the pyramids, "The silence of the desert triumphs where reverent pride made its proudest displays." The world-renowned remains of immense cities, of those marvellous proofs of human labor found in the pyramids, sphinxes, obelisks, catacombs and temples, far exceeding in extent anything to be found in Greece or Rome, testify of a country, fertile and populous, outside the narrow bounds of the inundated valley of the Nile.

This wide desolation in Assyria, Babylonia and Egypt is now generally admitted to have been caused by a bad system of agriculture, — taking everything from the soil and returning nothing to it.

As an illustration of the little value placed on fertilizers even in later days may be mentioned the fabled cleansing of the Augean stables by Hercules, — who seems to have been the inventor of the modern system of sewage, — where the accumulations of 3,000 cattle for 30 years is said to have been washed into the sea in a single day. This, if the event could have occurred, would represent a loss of more than a million dollars' worth of plant food. To produce without manure the amount of food required for those cattle would totally exhaust 10,000 acres of our ordinary New England soil. Authentic instances may be found in ancient history where too great exhaustion of the soil has been followed by barrenness and a decrease of population, notably in Palestine, Asia Minor and Persia. Reference to these is enough for our purpose.

Some years since, in a discussion before the West Newbury Farmers' Club, a member from Newburyport, T. K. Bartlett, stated as within his own knowledge that on some portions of Grasshopper Plains, so called, where was once good corn land, the soil had been so exhausted as to leave only shifting sands.

In my own neighborhood is a portion of a pasture that years ago was said to be "ryed to death;" that is, its fertility had been so exhausted by repeated cropping with rye, without any application of manure, that it had become unfit to sustain the natural pasture grasses, — nothing left but sand and moss.

The inquiry naturally arises as to the cause of this *extreme* barrenness, for it would seem by the result as if there might be some cause other than simply the exhaustion of the soil by cropping.

In human affairs we all feel the force of the proverb, "The poverty of the poor is their destruction;" and of that other saying, "To him that hath shall be given, and he shall have abundance, and from him that hath not shall be taken away even that he hath." This appears to be a natural law, and just as applicable to the forces that govern the fertility of the soil as to those that govern the affairs of human life.

In all soils there is a point above which the natural tendency is towards greater fertility, and below which the tendency is towards barrenness.

In the comparatively cool, moist atmosphere and frequent though gentle rains of England, summer fallowing may be and is practised with advantage; but in the hot, dry air and drenching showers of our summers it tends to impoverish the soil and is not practised.

"It has been proved by experiments that $8 worth of nitrates are annually washed away through an acre of bare fallow, and but $1.50 worth from an acre covered with crops, a waste of $6.50 from a single acre, simply from the want of a green covering."

On the other hand, in this country green manuring has its advocates, and has been practised to some extent. Land has been enriched by plowing in some green crop, as clover, that has been allowed to grow during one season. It returns to the soil more than it has taken from it. By its roots and leaves it has absorbed certain elements from earth and air, and by its vital chemistry elaborated certain organic material that has a stimulating influence on future crops. But it is manifest that this method can be resorted to only when there is a certain amount of productiveness already in the soil. Below a certain point more elements of plant food will be taken from the soil by evaporation and leaching than will be returned to it by plowing under the scanty crop.

If the humus is abundant, the soil not only retains the fertilizers applied by art, but also that supplied by nature, — by the atmosphere, rain and snow ; but if the humus becomes exhausted, the remaining barren earth fails to retain the manures applied, the fertile elements being leached through and lost in the deep subsoil. Hence, above a certain point in fertility the copious showers of heaven are a blessing, and below that point they do but consummate the curse.

Green manuring is nature's method of increasing the fertility of the earth. The yearly return of the whole plant to the soil, if it is an annual, or if a perennial, the annual return of its leaves, and in time of its whole trunk, kept up from generation to generation, produces that accumulation of humus that made the virgin soil of our New England so productive of the grains and grasses in earlier days, and still makes the productiveness of the great prairies of the West ; while, on the other hand, the leaching of the soil that follows excessive cropping, combined with other causes, such as diminished rain-fall, dryer winds, and finally moving sands, has been and is nature's method of producing that utter desolation found in some portions of the Old World. To a soil that hath much fertility more shall be given, and it shall have abundance, and from a soil that hath little fertility shall be taken away that which it hath, and it shall be poor indeed.

An indispensable element of plant growth is moisture, furnished mostly by rain-fall.

In the primitive condition of our country, the dense forests were conservators of the moisture from the clouds. By their roots, fallen trunks and leaves ; by the underbrush, ferns and mosses growing in their shade, they retarded the flow of streams, they held the water as in a sponge, and prolonged the period of drainage of the melting snows and spring rains even during the entire summer. But the forests having been largely cut off, the waters rush unckecked down the naked hill and mountain sides into the creeks and rivers and are carried off in devastating floods, to be followed by droughts, alike injurious to agriculture, to navigation and to health. The effect of this change may be seen on a small scale, even in my own town of West Newbury. Three different streams within our borders formerly afforded useful mill privileges. Now at midsummer one can walk along their beds dryshod.

The disastrous effects of forest destruction have of late been attracting much attention. New York is much concerned for the preservation of the forests of the Adirondack region, the great reservoir for the waters of the Hudson River. The State of Connecticut is waking up to the importance to her of the forests along the head-waters of the Connecticut River in the States of New Hampshire and Vermont, and the dwellers along the valley of the Ohio are looking at the destruction of the forests of the Alleghany region as the cause of the devastating floods of 1882 and 1883.

These disastrous effects are evoking a great deal of discussion. I think we may take it for granted that the amount of rain-fall, in all forms, that comes to the earth from the air, is just equal to the amount of moisture evaporated from the earth, including, of course, its whole surface, — land and water. As rain-fall depends on evaporation, and is just equal to it, it follows that increase or decrease of evaporation will be followed by a corresponding increase or decrease of rain-fall.

It is a mistaken opinion that, other things being equal, the soil a few inches below the surface is more moist where shaded by luxuriant vegetation than where exposed to the direct rays of the sun. I was once standing with several others in a potato field where one-half the crop had been dug for early market, while the other half had been left to mature. The weather had been warm and dry, and the question came up, where shall we find most moisture, — where the potatoes have been dug and the bare earth is exposed to the sun, or where the potatoes are still growing? The answer, almost in concert, was, "We shall find most moisture where the ground is shaded by the vines." Investigation proved the contrary, beyond all dispute. Where nothing was growing, three inches below the surface revealed moist earth; while among the growing potatoes the soil was dry to twice that depth, the roots having absorbed the moisture, and the leaves and stems exhaled it into the atmosphere.

As a rule, the exhalation from vegetation will be in proportion to the amount of foliage and the luxuriance of its growth; least from the mossy, close-cropped pastures; more from the thrifty growing grains and grasses; still greater from the rampant growing corn, and most from the forest, with the moisture-loving air floating through its one hundred or more feet of perpendicular growth. The amount of exhalation from plants varies with the temperature and moisture of the surrounding air.

Experiments have shown that a sunflower with thirty-nine square feet of leaf surface gave off in twenty-four hours three pounds of water; grass sod, per square foot, one and one-half pounds per twenty-four hours.

In recent experiments a dwarf-bean exhaled during twenty-three days in September and October thirteen times its weight of water, which is more than half its weight each day; and if more than half its weight each day on an average in September and October, it would no doubt exhale double its weight in one hot day of July or August. An experiment has proved it. Sir J. B. Laws has proved that most plants during the few months of their growth exhale more than two hundred times their weight of water. That would equal five thousand tons of water from an acre of ensilage corn, supposing the crop to be twenty-five tons; and even that, I doubt not, is an under-estimate.

EVAPORATION.

Professor Burrill of Illinois says, "The amount of water exhaled from the leaves of trees in dry, hot weather is prodigious, — vastly greater than any one not acquainted with the results of experiments upon the subject supposes. As near as can be made out from investigations upon small plants in pots, a large-sized forest tree throws into the atmosphere every favorable summer day about fifty barrels of water, counting forty gallons to the barrel. One apple tree twenty years old may be estimated to be one-fifth as large, and to exhale ten barrels of water each clear and breezy day of June, July and August. This seems incredible, but it is not above the accurately determined facts with potted plants of many kinds."

The Washington elm at Cambridge, a tree of no extraordinary size, was some years ago estimated to produce a crop of 7,000,000 leaves, exposing a surface of 200,000 square feet, or about five acres of foliage.

Generally during summer, and especially if the season be a dry one, plants absorb from the earth all the moisture their roots can reach; and here is another element to be considered in connection with the fact that plants exhale moisture in proportion to their amount of foliage and luxuriance of growth. The roots of a scanty pasture grass extend downwards not many inches; of corn, they have been found six or seven feet below the surface, and tree roots have been found twenty-five feet below the surface. The deeper the roots, the larger the proportion of water absorbed by them and exhaled into the air by their leaves, and the less the proportion that escapes to the deep subsoil, and that finally, by springs, brooks and rivers, finds its way to the ocean.

It has been observed that forests draw rain. The atmosphere always contains more or less moisture; the higher the temperature the more it can contain. If, when saturated, its temperature be lowered it must part with a portion of its moisture in the shape of rain, dew, frost, snow or hail. If the air is not saturated it is constantly taking up more moisture by absorption from the soil, vegetation, water or snow on the surface of the earth. To give an illustration: As the trade-winds blow constantly across the tropical ocean west of Africa, the air becomes saturated, and on reaching the rising land and cooler air of the South American continent gradually parts with its moisture, until it finally reaches the eastern slope of the Andes, which rises up like a huge barrier, and demands, by virtue of its colder air, almost the last tithe of moisture it has received from the ocean. On passing over the summit of the range and down the western slope of the mountains the conditions are reversed. The gradually increasing temperature is far above the dew-point of the dried atmosphere, and gives it a constantly increasing capacity for moisture, and it demands and receives of the earth all it can possibly exhale. The rains of the eastern slope give rise to the largest rivers in the world, the Amazon and its tributaries; while on the western slope is a region absolutely rainless. I have ventured to refer to this somewhat hackneyed explanation of some of the phenomena connected with rain-fall, because it so well illustrates some points hereafter referred to in connection with forests.

Evaporation is a cooling process, and by this means forests cool the air for quite a distance above and around them, and thus have the same effect in condensing the moisture of the air blowing over them, as the coldness of the atmosphere incident to increased elevation. The moisture-laden air coming over an extensive forest is cooled below the dew-point, deposits its moisture thereon and becomes comparatively dry, and passing thence into the warmer air over the mossy pastures and scanty growth of exhausted fields far above the dew-point, not only does not give out any of its own scanty moisture to the parched earth, but carries off also the small amount evaporated therefrom. Thus though nature is no respecter of moral qualities, but sendeth her rain on the just and on the unjust, she hath regard for the faithful tiller of the soil, and sendeth her refreshing showers on his luxuriant fields and forests, while she withholdeth it from the soil of the unfaithful, who hath robbed it of all its fertility, again illustrating that principle in nature already referred to, that to him that hath shall be given and he shall have abundance, and from him that hath not shall be taken away that which he hath.

I quote a few reported facts in regard to the effect of forests on climate. In Italy the clearing of the Apennines is believed to have seriously changed the climate of the Po valley, and now the African sirocco, formerly unknown to this region, reaches the right bank of the river in the territory of Parma.

The removal of the pine forests near Ravenna induced the same desolating wind, and the same destruction of the old forests of Vosges and of the Cevennes has had a like deteriorating influence upon their climate.

In Egypt, where, during the French occupation in 1798, not a drop of rain fell for sixteen months, and where from time immemorial the country had been a rainless bed of sand, Mohamed Ali, by planting his millions of fig and orange trees, has seen his country blessed with an annual rain-fall of several inches.

Previous to the year 1821 the French district Provence was a fertile and well-watered region. In 1822 the olive trees which were largely cultivated there were injured by frost, and the inhabitants began to cut them up, root and branch. This, in effect, was like clearing off a forest, and in consequence the streams dried up, and the productiveness of the country was seriously diminished. The French have discovered that more can be produced with the land two-thirds cultivated and one-third covered with forest, than if all is cultivated.

It is claimed that the rain-belt in Kansas and Nebraska is moving westward. This is doubtless owing to the breaking up of the sod by plowing; the cultivation of the vigorous growing crops, especially the corn crop; the planting of trees, and irrigation. The secretary of the Board of Agriculture of Kansas claims that plowing alone tends to retard drainage and gives the growing crops a chance to arrest and throw off again into the atmosphere more of the rain-fall. He claims also that even if the rain-fall is no greater in the aggregate, yet during the growing season, June, July and August, it comes more frequently and more gently than formerly, and this also gives vegetation a better chance for moisture than when there were drenching storms and floods at longer intervals.

In Kansas and Nebraska there are about 20,000,000 acres under cultivation, nearly half that area in corn.

From the Agricultural Report of the State of Nebraska we learn that there were planted last year (1885), 248,496 forest trees, and there are now growing in that State 43,000,000 forest trees, where a few years ago not a tree was to be seen.

The Governor of Kansas is authority for the statement that in that once treeless State there are now more than 20,000,000 fruit trees, and upwards of 200,000 acres of forest trees planted by the inhabitants.

In Colorado, the State engineer estimates the area irrigated at over 1,000,000 acres.

The vigorous corn and wheat, and the fruit and forest trees are better evaporators of the moisture from the earth, as well as better condensers of the moisture in the air, than the native prairie grasses of Kansas and Nebraska; and the further west these are extensively cultivated in those States, and the greater the area of barren lands brought under cultivation by means of irrigation, the more will the "rainless desert" of the early explorers be visited by the verdure-making clouds.

Here in New England we all know how difficult it is to keep up the fertility of our soils, and how rapidly farms run down under unfavorable circumstances. It is a hard necessity that compels us to consume all the coarser products of the farm on the farm itself, — all the hay, grain, roots, etc., we take so much pains to garner into our barns and cellars. But a fertile soil, the world over, is the result of similar causes and is subject to the same laws, and we may regard the United States as one huge farm, with its hundreds of millions of acres, its soil subject to the same laws as any one of our New England fifty-acre lots. Remembering this, let us see what America is doing with her large farm.

During the last fifty-eight years she has exported more than 2,000,000,000 bushels of wheat, and of corn more than 1,000,000,000 bushels; and she is increasing the amount per annum at a most astonishing rate. In the ten years ending 1882 she exported to England, France and Germany more than $6,000,000,000 worth of agricultural products. This represents the total exhaustion of 260,000 acres of land annually. What has she imported to supply the waste of fertility by this enormous agricultural exportation? A few cargoes of guano and some German salts, but little compared with the waste.

But the exportation of agricultural products is not the only way by which America is impoverishing her farm. A large proportion of our population is found in cities and towns of over 10,000 inhabitants, and most of the food consumed therein is as much lost to the soil as if exported. Our cities — New York and its environs, with two and one-half millions of inhabitants; Philadelphia, with its one million — and other cities are huge monsters, living on the fertility of the country and pouring what they should return to the soil into the ocean through their herculean water-ways.

Of wheat, there was raised the past year over 500,000,000 bushels. If we consider exportation and loss by city sewage, it would be speaking within bounds to say not one-fourth ever finds its way back to the soil; but call it two-fifths, and then we have a waste of the fertility required to produce 300,000,000 bushels. The average crop we know to be about thirteen bushels per acre, and on the supposition that thirty years would be required to exhaust the wheat-growing soils, we find that to produce the wheat annually lost requires the annual exhaustion of 800,000 acres, about equal to the total tillable land in Massachusetts. If to this we add the corn and other grain largely exported or made into whiskey, tobacco (all of which is burned), cotton, hemp and flax, which draw largely from the soil, we get some idea of the waste annually going on. The Roman provinces are said to have been exhausted by the tribute exacted from them by their conquerors; but we venture to say that the tribute paid by those conquered provinces to the imperial government was small compared to the tribute America is annually paying to Europe, — drawing from her virgin soil to support the toiling millions of manufacturers in England, France and Germany.

Let no one suppose that the soil of our Western prairies is inexhaustible. There is no such thing as an inexhaustible soil. The surface of the earth was once barren, its elements all mineral, no humus, no organic matter, no fertility. Nature has been at work millions of years gradually supplying the organic matter and humus which now constitutes its fertility, and it may be remanded back to its natural mineral constituents, and become as barren as the original rock.

The soil of the West is already exhausted to a considerable extent. Even in Iowa complaint is made that the yield per acre is falling off. Old lands are being abandoned and new ones taken up. The average product of wheat per acre in New England is greater than it is in New York, Ohio, Wisconsin, Minnesota, Missouri or Nebraska, and very nearly equal to that in Michigan, Indiana and Illinois. If such is the case now with our 60,000,000 of inhabitants, how will it be when we have hundreds of millions?

The tendency of our modern farm machinery and the application of horse and steam power to agriculture is not only to exhaust the soil much more rapidly than would otherwise be possible, but also to make the exhaustion more complete, as by their help the cultivator can get remunerative returns from a soil so much exhausted as not to pay any profit if cultivated by the old method of hard labor alone.

In the progress of our modern civilization the tendency to city life is all the time increasing. The increase of wealth, luxury, education, fashion, amusements, manufactures, art and science makes the agricultural products consumed continually to bear a less and less proportion to the total expense of living; while the farm machinery, before referred to as making the exhaustion of the soil more complete, will also make, as it has already made, the proportion of our inhabitants engaged in agriculture continually less, because fewer laborers therein will be required to produce a given amount of food.

According to the census of 1870, of the persons engaged in all classes of occupation, forty-seven and one-third per cent were engaged in agriculture; in 1880, forty-three per cent were so engaged, — a relative loss of four and one-third per cent in ten years. It has been estimated that the effective force of a farm laborer has been increased five per cent in twenty years.

From the census of Massachusetts in 1855, 1865, 1875 and 1885 we find the following as the population of the cities and towns respectively at those several periods :—

	1855.	1865.	1875.	1885.
Towns, ...	714,521	726,950	754,666	757,372
Cities, ...	417,848	540,081	897,246	1,184,769
Per cent in cities, . .	.37	.43	.54	.61

While the increase in the cities during the last ten years has been, as you see, large, one hundred and forty-eight agricultural towns have lost in population, — among them more than half the towns in this (Worcester) county, and this town (Barre) has lost nearly thirty per cent in twenty-five years.

If to the causes already mentioned as increasing the tendency to city life we add the easy transportation of food and passengers by steam and horse railroads, it makes the concentration in large cities possible and probable beyond anything known in the ancient world. Some now born will doubtless live to see the time when New York City, with its environs, will contain 10,000,000 of inhabitants, and from 2,000,000 to 5,000,000 each in Philadelphia, Chicago, Boston, Cincinnati, St. Louis, San Francisco, and perhaps other cities. All this indicates a still greater waste from city sewage in the future than in the past.

As before observed, if the soil is not too much exhausted, nature is ever ready to attempt its renovation. She fills up the waste places with the lower forms of vegetation where the higher forms or wholesome plants will not grow, and these by their decay tend to increase the fertility of the soil and prepare it for a more useful growth. Thus the mosses, lichens, hardhack and birches take possession of worn-out soil, hold what is left of the humus, gradually add more, and finally work it back to fertility. But as there is a point in organic derangements beyond which nature loses her power or refuses to act and the patient dies, so when by continual cropping the organic material in the soil is removed, leaving but little except the mineral constituents of the earth, nature refuses to endure this repeated abuse and withholds her beneficent labors. The poverty of the soil will then become its own destruction. The sun will burn out and the rains will leach out any fertility yet remaining, and the winds will complete the work by making it a desert of moving sands; and judging by the past, if the soil is once destroyed over an extensive area there is no redemption.

Under the present prodigal waste of fertility in our country this result is only a question of time. The enormous demand from Western Europe, the waste of our cities, the application of improved implements and horse and steam power to agriculture, the increased facilities for transportation both by land and water, will tend to bring the same result to us more rapidly than it came to the ancient world, and make the desolation, if possible, more complete.

There are instances where a high state of civilization has extended over many hundreds or even thousands of years, while the productiveness of the soil has perhaps increased: notably in England, China and Japan. Islands are less dependent for their rain-fall on the evaporation from their own area than are continents. The British Islands especially owe their moist climate to the warm waters of the Gulf Stream by which they are partially surrounded. Nor is England an exporter of agricultural products, but, on the contrary, an immense importer, and not only of food, but, of raw material for her manufactories, and a large portion of the waste from these goes to sustain her soil. She is also a large importer of fertilizers direct, most of the Pacific guano having gone to her shores.

From China and Japan rice, the only article of food exported, is largely the product of low lands, partially dependent for fertility on inundations. This is also the principal food of the inhabitants. The condition of both these countries is somewhat analogous to that of some farms bordering on the marshes of our sea-coast, the owners of which are enabled to sell off the product of their upland, keeping up its fertility by the manure resulting from a liberal feeding of marsh hay to cattle.

The Japanese practise irrigation to a considerable extent. They also testify their appreciation of the importance of trees by laws which require the setting out of two for each one destroyed. It is said that, considering the large population on so small an area, the number of trees in Japan is astonishing.

To place the whole matter in proper light, we have only to ask the question, Had China and Japan been dependent on the product of their uplands for food for man and beast, and had they exported a large portion of all their agricultural products, and had they also practised our modern system of city sewage, at the expiration of 3,000 years would they have contained, as they now do, more than 500,000,000 of inhabitants, nearly one-half the total population of the globe, and their soil still furnishing an abundance of food for all?

Good reasons may perhaps be given for a law taxing certain kinds of imports, but it is by no means certain that a tax on some exports would not be the wiser enactment; nor is it indeed certain that the law of self-preservation would not justify some of the Eastern exclusiveness, and prohibit the exportation of agricultural products, except to a very limited extent. Can any one give a good reason why America should be ambitious to feed all the rest of the world at the expense of our posterity, to whom we are to leave exhausted soils?

The question may naturally arise, Has the climate of New England changed during the two hundred and fifty odd years since its first settlement? Without presuming to answer the question, a few suggestions may be made having a bearing on its discussion.

In regard to the droughts which are said to have occurred during the first one hundred years of the colony, proofs of which are supposed to be furnished by the number of days appointed for public prayer for rain, it must be remembered that the early settlers had few cattle and hence little manure, that their ploughing was shallow, and that they were accustomed to the moist climate of England; and it may be added in this connection that they cherished a strong faith in a special Providence, and hence a few days of hot, dry weather, that would scarce excite a remark with us, might fill their minds with fearful forebodings, and prompt them to fasting and prayer as the most available method of getting rain. Experience has taught us a more reliable remedy against drought in deep cultivation and high manuring, and hence the less frequent call for the special interposition of Divine Providence.

Again, it is now conceded that New England in 1620 was not the unbroken forest it is popularly supposed to have been. Forest fires kindled by lightning or otherwise had raged fiercely, destroying the timber; and we learn from history that the first settlers in many towns were attracted thereto by the "rich and extensive meadows which furnished abundant and most nutritious grass and hay for their cattle." In an address before your body last winter, by Rev. Joseph Temple, it was stated that Sudbury and Sherborn owe their early settlement to that cause.

For the last fifty or sixty years, during which reliable records of rain-fall have been kept, no decided change is observable. Why should there be? Thanks to the introduction of coal as fuel, there has been, in the southern half of New England, no reduction of woodlands. In my neighborhood, where one acre has been redeemed from forest ten acres of open field or pasture have gone back to wood. To this we may add the increase of orcharding and the shade trees which so beautifully adorn our cities, towns and villages. Our swamps and bogs, our rocks, steep hillsides and sandy pine lands, which render so large a part of our area unfit for tillage, may also have had a saving influence on our climate. It is not New England alone, however, that is to be considered, but the whole country, especially the vast valley of the Mississippi, where nearly the whole surface is capable of cultivation, and where the causes alluded to are most likely to culminate in disaster. Nor is it for our present population or for a few years, but for the hundreds of millions of people that should be our heirs at our first millenial.

But it is not well to look with sad forebodings into the future, unless it incite us to efforts to prevent threatened disaster. May we not hope that science and art will lend their influence toward better systems of agriculture? In the soiling system, so called, of feeding cattle, and in the ensilage system of preserving green food, which seems to be meeting with very general success, we see the dawning of a better day, as these systems for a given amount of dairy produce require a high cultivation of smaller areas, leaving the pastures to be remanded back to forests.

When our bleak hill pastures and mossy plains shall be a thing of the past, and their places supplied by a growth of cooling, rain-inducing trees, then, without any deleterious effects, our swamps and bogs may be drained and we shall find in them our most productive soil. An enlightened civilization may hereafter demand, by legal enactment, that no man shall own more land than he can properly cultivate and keep in luxuriant condition, and demand also the utmost economy in the saving of fertilizers.

Indeed, the aids to agriculture which science has already furnished may sink into insignificance compared with what she is yet to achieve in its behalf. She may yet come to the rescue and furnish the means of preventing the waste which now seems unavoidably incident to our large cities, when perhaps the water-closets shall be detached from the sewers, and when each family shall receive its supply of deodorizers, disinfectants and absorbents as regularly as its supply of food, and all effete matter, made inoffensive, and returned to the soil of the country. This may seem somewhat like going back to the bucket system of the Orientals; but that seems to have proved superior to our system of sewage, and modified by modern facilities for transportation and by advanced chemical science, may solve the problem which thus far has baffled the skill of engineers, sanitarians and agriculturists.

There is some movement in the right direction. The State of New York, now owning 800,000 acres in the Adirondack region, seeking to extend that area for the preservation of its forests; the premiums offered by the general government and by some of the Western States for the cultivation of forest trees; the Arbor Day, originating in Iowa and now extending through the neighboring States, which has been the cause of setting out millions of trees, and which we trust is to become a national institution and legal holiday, — all tend to impress the general public with the beneficent effect of forests as conservators of the soil of our national domain, and will tend especially to make all farmers feel that not Jove alone is the cloud-compeller, but that they also have that power and are responsible for its wise use.

When the true value of irrigation shall be understood and appreciated, less of our rain-fall will be allowed to be carried to the sea by our rivers, but by steam-power or water-power, or wind-power, which is many times greater than the water-power, the contents of our streams and ponds and lakes will be distributed over the land, to be absorbed by the roots of the luxuriant vegetation and exhaled into the air by its leaves, to be again precipitated as beneficent dew or rain.

If we as *citizens* are determined to transmit to our children our glorious heritage of civil and religious liberty, — purchased by the blood of our fathers, — our free schools, free press, free speech and free church, shall we not also as *farmers* feel it a solemn duty to transmit to them those most glorious of all blessings handed down from the ages, — a fertile soil and beneficent climate, the prime necessities of human existence.

If man will but do his part, he shall find nature no exacting creditor, demanding her pound of flesh, threatening to remand the earth back to the reign of death and desolation if her bond is not satisfied, but a generous friend and partner, ever active and vigilant, honoring all his drafts, while constantly increasing the deposits of plant-food throughout her ample domain. So shall the earth continue to the latest generations to bud, blossom and bear fruit in all the beauty, fragrance, luxuriance and bounty of the fabled garden of Eden, fit haunt of gods, where with our first pair the angels walked in converse sweet beneath the clustered vines and trees of choicest fruit.

No discussion followed this paper, but Mr. W. H. Bowker of Boston was introduced and delivered the following lecture : —

HOMŒOPATHY IN AGRICULTURE.

BY W. H. BOWKER OF BOSTON.

It may be inferred from the title of this paper that it is proposed to discuss the application of homœopathy to agricultural operations, or its adoption by the agricultural classes ; but such is not the case. I use the term "homœopathy" not in its medical sense, namely, that "like cures like," but in the popular sense of representing infinitesimal quantities ; and this paper, therefore, will discuss the infinitesimal and indispensable quantity in agriculture.

There are many quantities essential to successful farming. After the brains and capital are supplied, I take it that the most important quantity is that of plant food, and it is with the latter that I propose to deal.

In medicine, especially in the homœopathic school, it is claimed by its founder, Hahnemann, for example, that the one-millionth part of a drop of medicine of a certain known strength, frequently administered, is sufficient to effect cures in obstinate and virulent diseases. The truth or falsity of this assumption it is unnecessary to consider here. Certain it is that science has demonstrated and practice shown that medicine can be so compounded and afterwards so minutely subdivided, retaining its efficacy all the while, that the assumption of Hahnemann does not seem to be altogether unreasonable or impracticable. It is known that one drop of certain poisons or a whiff of certain gases will kill a healthy man. The drop can be measured, — the whiff it is impossible to represent. As extraordinary as the action of these infinitesimal quantities may seem, it is no more wonderful than the phenomena we witness every day in the growth of crops, especially where concentrated fertilizers are applied.

I have here upon the platform a bag representing the bulk of 100 pounds of fertilizer, containing the average amount of plant food which is found in some of the most concentrated fertilizers in the market; namely, 4 per cent. of nitrogen, 12 per cent. of total phosphoric acid and 4 per cent. of potash, or 20 pounds of actual plant food to every 100-pound bag of fertilizer. The smaller bag represents the bulk of the actual plant food contained in the larger.

Now it is proposed by way of illustration to plant a crop of corn, and to apply 1,000 pounds of this fertilizer to the acre, or, in other words, ten of these 100-pound bags. The actual plant food, if we could extract it, would amount to 200 pounds, which two men could easily carry on their backs into the field.

And right here you may ask why we are obliged to handle so much bulk for so little plant food. You have been told that fertilizers are concentrated plant food, while stable manure is bulky plant food, which is quite true; these statements being only relative. Fertilizers are more concentrated than manure, but are not as concentrated as can be made in the chemist's laboratory. As you have seen, in applying even the concentrated fertilizer, we are handling five times more weight than seems necessary; but it is impossible to extract the actual elements of plant food in a commercial way. All actual nourishment, whether for plants or animals, is enveloped in or combined with organic matter, which holds and carries it; so when we are feeding our crops, we are compelled to handle more or less of this organic matter, — a vast amount when applying manure, at least 100 pounds to 1 pound of nourishment; while in fertilizers it is much less, — about 5 to 1.

But to resume our theme. We are applying 1,000 pounds of concentrated fertilizer, or 200 pounds of actual plant food, to an acre of corn. An acre of land contains 43,560 square feet. If we take the average depth of agricultural soil to be 12 inches, then the acre contains 43,560 cubic feet of soil, through which this 1,000 pounds of fertilizer or 200 pounds of plant food is distributed. In short, it gives to each cubic foot of soil 160 grains of mixed fertilizer, or 32 grains of actual plant food. A cubic foot of arable soil, according to the best authorities, weighs from 80 to 90 pounds. Taking it at 80 pounds, an acre of soil weighs in round numbers 3,500,000 pounds, or 1,750 tons, and therefore we have only 2 grains of mixed fertilizer to each pound of soil, or two-fifths of a grain of actual plant food.

But let us put it in a more practical light. An acre of land planted to corn, with the rows and hills $3\frac{1}{2}+3$ feet apart, contains in round numbers 4,000 hills. Allowing 5 stalks to each hill, we have 20,000 stalks to the acre. Applying 1,000 pounds, it gives to each hill of corn one-quarter of a pound of fertilizer, or 350 grains of actual plant food, and to each stalk only 70 grains of actual plant food, which is equal to $\frac{1}{100}$ of a pound.

Is this not applying plant food in homœopathic doses? And yet 1,000 pounds to the acre of concentrated fertilizer such as I have described is a very liberal quantity for most crops. When I witness the growth of the corn crop, and think of the infinitesimal quantity of applied nourishment allotted to each stalk, — so little to produce so much, — it seems to me one of the miracles of nature, even more wonderful than the miracles of Scripture, some of which modern science claims to have explained.

But wonderful as this may seem, yet instances can be cited where smaller quantities of fertilizer are applied with equally astonishing results. Let us take, for example, an acre of grass land to which 100 pounds of nitrate of soda has been applied, and this quantity put on in the spring will frequently produce marked results, the grass taking on a very dark green color; and if the roots are vigorous, the weight of hay at harvest will be considerably increased. One hundred pounds of nitrate of soda contains in round numbers 15 pounds of nitrogen. Now this 100 pounds divided over the acre gives 16 grains of the nitrate to each cubic foot of soil, or one-fifth of a grain to each pound of soil; the total nitrogen which each pound of soil gets, is $\frac{3}{100}$ of a grain. Let us go a step further, and see what each grass plant gets. We were taught when at the agricultural college that "on rich old pasture, able to carry a large ox to the acre, it was found by actual count that a square foot had on it 1,000 grass plants. On a carefully manured and irrigated and very fertile meadow 1,800 plants were found; on a herd's-grass field, seeded heavily, but not bunched, 700 plants." Taking the herd's-grass field, we have in round numbers 30,000,000 plants to the acre. We find, applying 100 pounds of nitrate of soda, that each plant is entitled to $\frac{23}{100}$ of a grain, and of actual nitrogen, $\frac{35}{100000}$ of a grain. To put it more strikingly, when we apply 100 pounds of nitrate of soda to an acre of well-seeded herd's-grass, each grass plant gets the very liberal quantity of $\frac{1}{2,000,000}$ of a pound of nitrogen; *that is, each pound of nitrogen applied nourishes 2,000,000 grass plants.*

The more one contemplates the infinitesimal and incomprehensible quantity of actual nutriment required for plant growth, or even for man's development, the more one has respect for the views of such a scientist and theorist as Hahnemann, for it certainly seems reasonable to suppose that if infinitesimal quantities of food will nourish, infinitesimal quantities of medicine will cure.

Figures and theories, however, are wearisome, and oftentimes misleading. I have not arrayed them here to bewilder nor to excite curiosity, but for the purpose of making a few practical deductions. As we have proceeded, you have reached two important conclusions: first, dealing as we are with such infinitesimal quantities, you have seen at a glance the necessity of having the fertilizer which is applied in the best mechanical condition; second, that it not only must be distributed evenly, but thoroughly mingled with the soil, — two important points, but not those which I wish to emphasize at this time.

We are seeing much in the agricultural papers, and I am sorry to say in some books, touching the application of fertilizing materials in their natural or "raw" state. You will read from some writers who know little of science, and probably nothing of practice, that finely-ground South Carolina rock will give admirable results; that ground hoofs, hair, horns, wool and leather waste, and undigested fish waste and raw ground bone are all efficacious, and that it is needless to manufacture them in order to render them more available for plant nutrition. It is not for me to quarrel with these men, because from my standpoint as a manufacturer it will be said that I am prejudiced, and that if these notions should prevail, my occupation, like Othello's, would be gone. Nevertheless, there is reason in all things, and fortunately, in the manufacture and application of fertilizers, there is a great deal of science, which is but another name for divine law.

Forty-seven years ago, Baron von Liebig, the founder of agricultural chemistry, made a very important discovery, — perhaps the greatest of the age in agricultural chemistry. He found that the application of bone treated with sulphuric acid produced much better results than the untreated bone. Now, bone is tri-basic phosphate of lime, that is, three parts of lime to one part of phosphoric acid. It had been found before Liebig's time that sulphuric acid had a greater affinity for lime than phosphoric acid, and that when sulphuric acid was applied to phosphate of lime, whether in the form of bone or in the form of natural phosphate, it would take one part of the lime, forming sulphate of lime, and leave two parts of lime in combination with one of phosphoric acid, or a compound which is soluble in water, and therefore, if applied as a fertilizer, much more available as a plant food. This soluble combination of the sulphuric acid and lime is not a chemical liberation of the phosphoric acid, but is a mechanical condition so finely subdivided that plants can take it up. It is still a mooted question whether plants have the power of extracting the phosphoric acid in the laboratory of their roots, or whether the soluble phosphate of lime is taken bodily into the plant and digested either in the stalk or leaves. But it is claimed that when this superphosphate — for that is its true name — is applied to the soil, the soluble phosphate of lime reverts, or goes back, to a state in which it is not soluble in water, but is soluble in the acids of the soil or in the mechanism of the plant. It is no doubt true that the soluble phosphate of lime does revert after it has been in the soil some length of time. From this a few scientists have reasoned that it is not necessary to dissolve any phosphatic compound in sulphuric acid, and so conclude that phosphate rock or raw ground bone is just as valuable as that which is dissolved. Such reasoning, however, is opposed to experience and common sense. Forty-seven years of experience since Liebig's time have shown that no mechanical division can be made equal to that produced by the action of the sulphuric acid upon the phosphate of lime. Mill after mill has been invented, process after process tried, for the reduction of phosphates to a condition equal to that produced by chemical means, and yet all, with possibly two exceptions, have been cast aside.

It is found that bone, treated with steam under high pressure, will yield a small percentage of reverted phosphate of lime, — never soluble. It is probably true that mixing bone with an alkali and allowing it to heat will render a portion more or less reverted, but never soluble. Steam and alkali, however, have no effect on natural phosphates like South Carolina rock or Canadian apatite. Neither is effective, except when animal matter is present to assist by its decay the process of disintegration.

It being generally admitted that soluble phosphates become partially insoluble after application to the soil, it is of course a very natural question to ask, "What is the need of dissolving them at all? Will not the soil act upon them if they are finely ground, so as to render them gradually available?" Doubtless it will if you give it time; but time is an important element. If you are growing century plants or oak trees, it would not be advisable to apply soluble phosphates; but these are not the cultivated crops of this section. On or before the 25th of next May, if we live, and the weather and other conditions are favorable, most of us will plant a crop of corn, which not only must be supplied with carbonic acid, oxygen and hydrogen, which it gets from the air and water, but with a large amount of phosphoric acid, from the time it begins to send out little rootlets until the ear turns yellow and sere, — 100 days from the time it is planted. The question is, will the phosphate rock or the ground apatite furnish the phosphoric acid that is needed in the 100 days as rapidly as the plants require it? This really, then, is the practical problem. No doubt, for the oak tree or century plant sufficient phosphoric acid would become available, but for the corn plant, the rock or the apatite would be a failure. On the other hand, with bone it might be a success. If the season happens to be early and moist, and the bone very finely ground and very highly digested with steam, you may succeed, but if the bone is raw, or coarsely ground, or the season dry, you will make a failure; and how many failures you can afford to make by adhering to the plan of applying insoluble phosphates to the corn crop, whether in the form of bone or rock, will depend upon the length of your purse.

Early potatoes are planted on the first of May and harvested on the first of August, — ninety days, — needing phosphoric acid every day of their growth; and every practical farmer knows that a potato must grow quickly and continuously to be a success. It is possible that on moist soil, and in a wet season, which is at best an unfavorable one for potatoes, you would get fair results with the application of ground bone, but never a great success; and as to planting potatoes on raw, undissolved phosphate rock, I have yet to hear of a successful crop being grown; and I can't believe it is possible, even under the most favorable conditions. There is no quick-growing crop that can safely be planted on insoluble fertilizers, and the man who advises it reasons from the side of expense, and not from the side of common-sense and practice. It is true, it is less expensive at the start to apply them in their crude state, but in the end the results will be found uncertain and unprofitable.

England, as a whole, possesses a moist soil and a humid climate, but her chemists think so little of insoluble phosphoric acid and reverted phosphoric acid, that they put no value upon them. They even go so far as not to make a test for reverted phosphoric acid, believing that it is so uncertain a compound that its manufacture should be discouraged. Consequently you will find the English phosphates to be almost wholly soluble in water, the manufacturers going so far in this direction that their goods are usually wet and in poor mechanical condition. You would not buy them here, for you could not use them in machines, and you would think you were getting too much water.

There may be places where insoluble phosphates can be advantageously applied, as upon lands covered with fruit trees or devoted to grass. Perennial plants, like grasses and trees, no doubt extract phosphoric acid more readily than annual plants, owing to their numerous and well-developed roots, which, as in the case of trees, not only run deeper, but are ready at the beginning of the growing season to draw nutriment from a large mass of soil. Winter grains, especially wheat, from the long time it occupies the ground and its growth in the fall, may also be benefited by an insoluble or partially insoluble phosphate. If these latter crops are grown in the spring, when the rapid-growing conditions of heat and moisture exist, then it will be found that these inert compounds are too slow. So, on the whole, we must conclude that for most crops it is much better to have the phosphates, at least, of our fertilizers in a soluble condition. The quantities of plant food which we apply are so infinitesimal, and the time so short for growing most crops, that it must follow that the more finely the phosphate of lime is subdivided, the surer and more profitable will be its application. In fact, availability is so essential a condition that the wise husbandman will not overlook it, especially in the growing of quick crops.

While there may be some latitude allowed touching the availability of the phosphoric acid that we apply, there is certainly no question but that the ammonia and potash should be in active forms. Chemical salts, such as sulphate of ammonia and nitrate of soda, also blood, meat and fish, are all more or less active ammoniates, the chemicals especially so, and particularly essential where nitric acid is wanted in the first stages of growth. I mentioned the application of one hundred pounds of nitrate of soda to an acre of grass land, giving only fifteen pounds of nitrogen to the whole acre. Now you may apply to an adjoining acre one hundred pounds of leather waste, containing the same amount of nitrogen, and never see any results, because in the latter the nitrogen is so insoluble that plants gain no benefit from it, or if they do, so slowly that the results are not apparent. Dried fish, for example, applied to the surface of grass land is never satisfactory, either because it loses its ammonia into the air, or because the process of decay is so slow that no results are witnessed; but when the same dried fish is applied in the soil, where it is converted into nitric acid or some active agent, then it becomes a valuable plant food, thus showing that fish when applied under certain conditions is effective, but reverse those conditions, and it becomes almost a worthless fertilizer. Indeed, the same holds true of all other ammoniates, when applied without chemical treatment, excepting chemicals.

If it seems necessary to have the ammonia and phosphoric acid available, what must be said of the potash? The granite rocks of our hills contain enough potash for all our crops for all eternity. Those who think it advisable to use phosphate rock in its natural condition should with equally good reason recommend the application of granite rock. To be sure, it is not as rich in plant food, but the plant that can find the thousandth part of a grain of nitrogen can also find the most minute quantities of potash; yet no grinding, however minute, or even chemical dissolving, has rendered in a practicable way the potash of these rocks immediately available. Therefore for our potash we are compelled to fall back upon other forms which are soluble in water, and hence beneficial. The rocks have been, and still are, the great sources of potash. Virgin soil represents the accumulation of untold ages, which the husbandman in his greed and hurry can exhaust in one generation. Would it be wise for us, who are raising quick crops, and competing with the West and South, to depend upon the granite rocks for our potash? Yet such should be the advice of those who urge the application of fertilizers in their natural state.

It seems to me that there can be but one conclusion, and that is, that the availability of all the essential elements of plant food is of chiefest importance. We have plowed and planted; the seed has come up, and gives promise of a fair harvest. Perhaps we have staked all on that harvest, — the payment of debt, taxes, and support of family; yet we shall surely be doomed to disappointment and failure if that infinitesimal quantity of plant food, so essential, is yet so tightly locked in nature's grip that it is of no service when most needed. A young crop without available plant food at hand is like the ancient mariner at sea, when the albatross began to be avenged, —

> "Water, water everywhere,
> And all the boards did shrink;
> Water, water everywhere,
> Nor any drop to drink."

So there is air, sunshine, moisture, — an abundance of raw mineral food on every hand for the young crop, yet it, like the crew and boards of that ancient ship, shrinks and withers away because, forsooth, there is not a single morsel of all this abundance immediately available for the starving crop.

It is a cardinal principle in homœopathy to eliminate chance, so far as possible; hence the single remedy administered in minute but frequent doses in order never to aggravate the disease, but to cure it, if it is curable. In a certain sense, agriculture might adopt this principle. All chance, so far as possible, should be eliminated. Probably, also, there are many crops to which it would be well to administer plant food frequently during the growing season rather than all of it at one time; in short, to "feed the crop a little at a time, and often," in order to counteract any unfavorable weather, or any unhealthy development, or to push the crop to an earlier maturity to take advantage of a favorable market. In 1885 I saved a crop of corn by applying a little nitrate of soda at a critical juncture. At best, we are obliged to take a great chance in the weather. Can we in any way afford to multiply the chances in matters over which we have control, and with crops whose short lives span but a brief three months?

Next to availability and mechanical condition is that of adaptability, and by this I mean supplying to plants that form of plant food best adapted to the crop or classes of crops to be grown. I know that I am touching a point that has been much discussed. I know there are men who claim that the adaptability of plant food is of no practical consequence, and is too fine a thing for any one to attempt to fathom. That it is a great problem, there is no doubt, but the scientist who contends that it is impracticable, or beyond us, must also admit that his occupation, so far as further experiments with fertilizers are concerned, is at an end; for if there is nothing to be determined in the direction of the chemical functions of plant food, what is the use of further work in this field? We have learned what we have not to learn again,—that nitrogen, phosphoric acid and potash are the three leading elements of plant nutrition. We have found that they should be available for the best results. But this is not all. The work now in hand is to determine the adaptability to crop production of the various forms in which these essential elements occur; and not alone this, but also to ascertain if there are not other compounds valuable as plant food, with their special offices in this great field.

We have already made great strides in this direction. For example, we know that certain forms of potash are more beneficial to certain crops than are other forms. In Germany, they have found that the sulphate of potash is better than the muriate for the sugar beet, increasing the percentage of sugar. Valuable and extensive experiments with grapes, conducted by our own Goessmann, than whom there is not a more original and painstaking observer in the land, point to the probable conclusion that the sulphate of potash will produce a sweeter grape than the muriate, and therefore is to be recommended for this crop. In the treatment of the peach tree, Goessmann, in connection with Professor Penhallow, tells us that chloride of potash and magnesia, together with phosphoric acid, is an excellent mixture to apply to peach trees as a means of preventing the yellows, and developing a healthy wood. This, then, is adapting the form of plant food to the crop, or, in other words, is special feeding of the sugar beet, grape vine and peach tree. In writing on this subject, Dr. Goessmann says, in a paper read before the Massachusetts Horticultural Society in 1882, "The result of these experiments affords an additional illustration of the opinion that special fertilization must be considered a factor of more than ordinary importance in fruit culture."

And in another paper he says, "Even the peculiar form in which potash, etc., has been applied, is known to exert a decided influence on the production of one or more organic constituents of plants."

The tobacco growers of this country, especially those in the Connecticut valley, have found that not only certain ingredients, like salt, must not be applied to tobacco, but that certain forms of potash, like the sulphate, are essential to the production of a good leaf, and that the form of the ammonia also has an influence upon the crop. Touching this subject, Professor Johnson of Connecticut, in his annual report for 1884, says: —

"It would be going too far to assert that the use of chlorides (muriates) of fish or slaughter-house fertilizers must invariably produce tobacco of inferior quality . . . The tobacco growers will, however, do well to avoid the use of the above-named fertilizers, which experience in all countries agrees in indicating to be, as a rule, likely to injure the burning quality of the leaf;" which means that certain forms of plant food are probably better adapted to tobacco than are other forms.

Twelve years ago I was requested by some of the farmers of the Connecticut valley, notably the late Mr. Hurd of North Hadley, who was one of the most intelligent tobacco raisers in the State, to manufacture a tobacco fertilizer. I was then fresh from the instruction of Professors Goessmann and Stockbridge, and having little experience in business and knowing nothing of costs, I set to work to make this compound. I made it of two ingredients, nitrate of potash and dissolved bone. The nitrate of potash furnished the nitrogen as well as the potash, and the bone the phosphoric acid. It cost $100 a ton, for saltpetre was then worth $160 per ton in gold, and bone $50 per ton. As you may imagine, I sold but little, for in announcing its cost I almost paralyzed the farmers. However, Mr. Hurd and several other progressive men were determined to try it. The result was entirely satisfactory, and I think as long as Mr. Hurd lived he used this mixture, raising a leaf that brought the highest price in the market. This fertilizer, however, was doomed to failure on account of its cost, yet

I firmly believe that if farmers could afford to use nitrate of potash, which is now worth $120 per ton, on their tobacco, in connection with soluble phosphates, it would furnish the forms of plant food especially adapted to the tobacco crop. But, on the other hand, nitrate of soda in place of nitrate of potash would be out of place. Both are nitrates, one furnishing potash and nitric acid, which are essential to tobacco; the other, nitric acid and soda, or only one essential ingredient, united with one (soda) not only non-essential but probably injurious.

The French consider the raising of tobacco so important a subject that they have established a laboratory in France to investigate all questions connected with its culture and manufacture. They are trying to determine what forms of plant food applied to this crop will produce a leaf which more nearly corresponds to that grown on virgin soil, "which cheers but not inebriates," and which gives so much solace that it is doubtful if the world is not happier for the existence of this so-called "vile weed."

I am sure that all genuine lovers of tobacco will consider that man a great benefactor who discovers a fertilizer that shall produce in this country, or even in Cuba, where the climate is more congenial, that old-fashioned dark-brown, fine-veined leaf which holds fire, burns freely, with a compact and clinging ash, and with an odor, aroma and taste known only to such tobacco. When such a leaf is produced, it will mean special fertilization, which has been more or less ridiculed, but which is bound to come to the front, if there is anything in science.

Not alone does it apply to a few special crops like the grape, peach and tobacco, which are difficult to grow, but it is equally applicable to all classes of farm produce. It is generally admitted that certain kinds of manure will produce a better potato than other kinds. For example, that better potatoes can be raised on horse manure or well composted stable manure, than on hog manure or green cow manure; and I think it has also been proved that a better quality of potatoes can be raised on fertilizers than on any kind of stable manure. I know that my own experience and that of many practical farmers point in this direction. I think better potatoes have been raised upon my farm in Barre, Mass., which is a heavy clay soil, on fertilizers, than were ever raised on stable manure. The crop has not always been as large as could be desired, but invariably of the best quality for the table. The specific for this crop I believe to be a combination of muriate of potash (not sulphate, as formerly supposed) and soluble phosphoric acid, with a liberal percentage of ammonia, a portion of which should be in the form of chemicals. Where such a combination has been applied, the crop has usually been of excellent quality, free from rot and disease of any kind. To my mind, this favorable action is easy of explanation. It not only contains the plant food in an available condition, but so much of it is in the form of sulphates and chlorides that the immediate and continuous formation of starch is probably induced in the tuber, and hence a healthy growth from beginning to end. The fact, also, that some of the ammonia is in the form of chemicals, and therefore active, aids in the early development of the plant. On the other hand, if animal ammoniates are used entirely, time is required to develop the plant food, which, if conditions of warmth and moisture are not favorable, might be furnished so slowly as to retard growth. Also the presence of too much decaying organic matter favors the generation of parasitic germs which appear as rot, rust or blight. I believe this, in part, explains the reason why fertilizers are better than manure for potatoes, or in fact for any crop that matures its product in the ground, like onions, beets and turnips. There is less decaying organic matter present in the fertilizer to foster the development of these fungus growths which are becoming more and more destructive.

Whether the mixture that I have suggested is the right one for potatoes or not, I feel confident that the fertilizer of the future for this crop will be a special one, and be much different from that used on corn, or grass. I have found that a fertilizer which is prepared for corn, for example, will not give so satisfactory results in every case when used as a top-dressing for grass.

I spoke a few moments ago of the application of one hundred pounds of nitrate of soda to an acre of grass land, that it would show marked results. On an adjoining acre I have applied one hundred pounds of animal dust (blood or meat), containing fifteen pounds of nitrogen, with no satisfactory results. The same quantity of nitrogen is present in each case, but in one it is present as nitric acid, and immediately goes to the nourishment of the crop, and in the other it is present in organic matter, and must undergo a process of oxidation and decay, and be converted into nitric acid before it becomes plant food. While it is undergoing that process it is either subject to loss on the surface, or the process is so gradual that no apparent results are produced, going to show that for surface dressing that form of nitrogen which is immediately available is much better than one which requires time to develop, and hence a surface dressing for grass should be composed almost entirely of chemicals.

The market gardeners have found that sulphate of ammonia is a specific for spinach, which, applied in March or April, and being immediately available, forces the crop to early maturity, and gives a dark green leaf, inducing the rapid and healthy formation of chlorophyll. Fish will not answer, blood does not work, and even nitrate of soda does not seem so efficient on this crop as sulphate of ammonia. On the other hand, nitrate of soda seems to be a specific for asparagus, and large quantities are being used in the fertilizers for this crop. It is applied in the spring, and seems to induce early and abundant cuttings, which are tender and juicy. Judge French of Concord, Mass., considered nitrate of soda, if not a specific, certainly an excellent fertilizer for asparagus, and he always raised a good crop. Dr. F. V. Noyes of Billerica, Mass., has also found that nitrate of soda was especially adapted to asparagus. In fact, any crop which produces a large amount of green succulent growth seems to be benefited by the application of ammonia salts, and asparagus being a native of saline shores, is no doubt benefited by the soda as well as the nitric acid.

Perhaps the most marked illustration in the way of special feeding is that of the turnip. It was discovered long ago in England that phosphoric acid, or soluble phosphate of lime, was a specific for this crop. An English writer, commenting upon this subject, says: —

"It is as an application to the turnip that phosphoric acid is so marked in its effects, even when the soil already contains it in considerable quantity. The reason of this it is not difficult to trace. The seed of the turnip is small, and it is sown in the warm season, when the growth is rapid. The seeds themselves have only a limited quantity of phosphates stored up for the benefit of the roots and leaves of the young plants. Unless the roots, therefore, while yet short, meet with a concentrated supply, the other elements of the food of the plant,— carbonic acid, water and ammonia, — however abundantly they may be present, cannot be assimilated, and the growth is arrested. Besides, a liberal supply of phosphates has the effect of pushing on the turnip through its early stages, when it is so liable to injury from various insects."

In this connection I wish to give an experiment with stock beets raised entirely on plain superphosphate. The variety is what is known as Joseph Harris' Improved Stock Beet, a sample of which I have here upon the table, and which, as you will see, looks very much like the rutabaga turnip. Mr. W. W. Phipps of Albion, N. Y., raised this year 1,266 bushels of these beets on one acre, applying no stable manure, but, instead, 2,000 pounds of plain superphosphate, containing about fourteen per cent. available phosphoric acid, but no potash or ammonia. The field in which these beets were raised is a dark loam, about eight inches deep, with a clay subsoil well underdrained. The seed was sown May 20, with an ordinary grain drill, twelve pounds to the acre, in drills twenty-eight inches apart. The plants were thinned out from eight to twelve inches. Level culture throughout the season. The crops that had been raised on the piece in previous years were wheat in 1881, with twenty loads of coarse barnyard manure, and one hundred and fifty pounds of fertilizer to the acre. It was seeded to grass in 1882 and mowed the two following years. In 1885 it was planted to beans with one hundred and fifty pounds of fertilizer, — no other manure; and in 1886 it was planted to beets, as above stated. The crops of wheat, hay and beans were all large ones, so it must be concluded that there was but little, if any, of the value of the previous manuring left in the soil, and that this large crop of beets was the result of the application of the plain superphosphate. The quality of the beets you can judge. To my mind, a ton of such sweet roots is to be preferred to a ton of sour ensilage, and the tonnage per acre is fully as large.

The special fertilizer then for turnips, and probably for stock beets, is one wherein phosphoric acid largely predominates; but who would think of applying phosphoric acid alone to cabbages, onions or squashes? Yet these crops, no doubt, have their specifics, and if we only knew them, and applied them at the right time, would rarely fail of a healthy and perfect maturity.

Take, for example, the oat crop. It is known that oats have a great range of weight per bushel; Professor Johnson says, "Being nearly twice as heavy when grown on rich land, as when gathered from a sandy, inferior soil." According to the agricultural statistics of Scotland for the year 1857, the bushel of oats produced in some districts weighed forty-four pounds, while in others only twenty-four pounds.

Now, knowing the right fertilizing ingredients to apply to oats, there is no reason why we should not invariably produce plump, heavy seed, provided always the season is favorable. I believe we do know very nearly what is needed for this crop. In my judgment, oats require a liberal quantity of nitrogen, phosphoric acid and a moderate amount of potash in the form of muriate; also, the presence of soda, — not because soda is taken up to any great extent by the crop, but because a little is needed to facilitate the assimilation of silica to stiffen the back of the crop and keep it from lodging. I know that Sachs, Wolff and many others have raised oats by water culture, without the presence of soda or silica; but this does not prove to my mind that it is not advantageous to have soda present in the fertilizer applied. This soda may be present in the form of salt, or in the form of nitrate of soda; preferably in the latter form, because the nitric acid of the nitrate is of great benefit in the early development of the crop. Lawes and Gilbert, I believe, consider nitrate almost indispensable in the growing of grain crops.

I have raised this year on 3.4 acres, 160 bushels of oats (threshers' measure), that weighed 40 pounds to the bushel, giving a yield per acre of 57 bushels of 32 pounds each. The land was given 60 pounds of nitrogen, 100 pounds of phosphoric acid and 300 pounds of salt per acre; no potash at all. The potash, however, had been applied in the four previous years in more abundant quantity than the alternate crops of potatoes and grass had taken out. Now one experiment does not establish a rule, and I am therefore not prepared to recommend the application of salt to the oat crop. Oats, like asparagus and tobacco, are gluttonous feeders. Planted on a rich soil in a favorable season, or given ample nitrogen, phosphoric acid and potash, they will grow so rankly that unless something is present to stiffen the straw, the crop will lodge and be ruined. My crop had more nitrogen and phosphoric acid than was needed, and enough potash. The season was favorable, and the crop would undoubtedly have lodged, as it did in some places where the salt was not applied, had it not been for the presence of the soda or possibly of the chlorine also, both of which the salt contained. The precise office of chlorine and soda in agricultural chemistry is not fully known, but I feel, from my own experience and that of others with whom I have conversed, that the application of soda, either in the form of common salt or of nitrate of soda, can be advantageously applied to any greedy crop which is predisposed to lodge when planted on a rich soil, or one that is over-fertilized. The oat is plainly such a crop, and is about the only one growing in this section to which it seems advisable to apply soda in any form.

Under the head of "Functions of the Ash Ingredients," in "How Crops Grow," Johnson says: "The albuminoids, which contain sulphur as an essential ingredient, obviously cannot be produced in absence of sulphuric acid, which, so far as we know, is the single source of sulphur to plants. The sulphurized oils of the onion, mustard, horse-radish, turnip, etc., likewise require sulphates for their organization. . . . The organic acids, oxalic, malic, tartaric, citric, etc., require alkalies and alkali-earths to form the salts which exist in plants, *i. e.*, bi-tartrate of potash in the grape, oxalate of lime in beet leaves, malate of lime in tobacco;

and without these bases it is perhaps, in most cases, impossible for the acids to be formed."

I might go on citing instances where certain forms of plant food seem to be more beneficial to certain crops than are other forms, showing that plants have the power of selection, and invariably exercise it if given the opportunity. And after all, why should it not be so? A plant that has the delicate organism by which it can run through the soil and gather up the most minute morsel of nutriment, must be capable of distinguishing between the forms of plant food that are present. It is known that plants will substitute, for example, soda for lime, magnesia for potash; but it is thought that they never do substitute, when the right form is present. When plants are forced to substitute, or forced to wait for some form of food to be developed, then an unhealthy condition is the result, and we have rot, rust, mildew or yellows. To be sure, these may not entirely be due to the plant food in the soil; but it has been demonstrated over and over again that a healthy plant will withstand disease, and a healthy plant means one that is properly fed from beginning to end.

Dr. Goessmann has taught this over and over again. He says, in speaking of fruits: "It is quite certain that the practice of returning to the soil, in suitable form and in due time, those constituents which fruits abstract, will give us larger crops by stimulating a vigorous condition of the entire plant."

Again, he says: "A strong, healthy plant is, of course, better able to overcome interior local disorders, and to resist external injurious influences more successfully, than feeble specimens."

Health in man, beast or plant presupposes certain healthy conditions, one of which is proper feeding. Men have been ridiculed because they have drawn an analogy between the feeding of plants and the feeding of animals. It is true that there is not so much difference between the feeding of plants as between that of different animals; nevertheless, there is a difference, slight though it may appear, and yet so important that if it is not recognized it means failure every time.

Because we do not know what the physiological functions of the different forms of plant food are, it does not follow that these different functions do not exist; and if they do exist, why they should not be considered in the cultivation of crops. That different forms of plant food have different functions there is no doubt, and the work of the future is to discover these functions, and to make combinations that shall be adapted to the crops we are growing. Agricultural chemistry began with the discovery of the elements essential to plant growth; it will not be complete until it has discovered the various functions of these ingredients, and adspted them to the wants of man.

We hear a great deal now-a-days about "complete fertilizers," — as though a "complete" fertilizer was a "sine qua non." Ammonia, phosphoric acid and potash form a "complete" fertilizer in the popular acceptance of the terms, but not necessarily a perfect fertilizer. If it contains but one per cent. of ammonia, one of phosphoric acid and one of potash, it is a "complete" fertilizer; and if it contains ten per cent. of each it is still "complete." It may contain one or all three of these forms of plant food in insoluble forms, and still be "complete ' in the popular sense. A "complete" fertilizer is a kind of manurial blunderbuss loaded with several kinds of shot, and expected to bring down all kinds of game, or rather to send up all kinds of crops in abundance and perfection. Now, a "complete" fertilizer can be made — in fact, is made — that seems to work well on most crops. A high grade superphosphate with ammonia and potash is an excellent fertilizer, and when used in connection with stable manure, or on a rich, unexhausted soil, is probably a good combination for general farm purposes; but to contend that fertilizers begin and end with a manure that is simply "complete" is to assume that there is nothing more to be learned in this field. Superphosphate of lime was the starting point; then followed the addition of ammonia and finally that of potash, and we had the so-called "complete" fertilizer, still valuable, but by no means perfect. After that came formulas based upon the analyses of crops, — a great step in the right direction, the promulgation of which quickened agricultural thought and opened the door to that great but almost wholly unoccupied field of "chemical physiology," or the specific action of chemical salts and fertilizing ingredients upon plant growth; in short, the adaptability of fertilizers to crops, or plant feeding with specific objects in view.

Out of these many years of discussion, experiment and practice the plant has come to the front, and says: "Consider me; soil, season, seed and cultivation are all important factors, but study me and my wants. I sustain man; know then how to plant me, how to cultivate me, and above all how to feed me, for if you feed me, I will feed you." I believe that we are just at the threshold of discovery in this field of plant feeding. Since I began the manufacture of fertilizers, many new forms of plant food have come into our market, and it must follow that some of these forms have their special place in the chemistry of fertilization. The new forms are, notably, sulphate of ammonia, sulphate of potash, muriate of potash and sulphate of magnesia, — fertilizing substances that were not known to farmers in this country fifteen years ago, but which are consumed in enormous quantities to-day. Who knows but that fifteen years hence other new compounds, like phosphate of potash, nitrate of ammonia, for example, now known only to the chemist, will play an important part in the economy of crop production, while some of those now prominent may drop out entirely. Salt and plaster have already taken a back seat; other forms may follow sooner than we expect; but whatever the outcome, it stands to reason that all fertilizing ingredients, whether new or old, have their especial place in the chemistry of fertilization, and it remains for us to discover that place in order to put agriculture upon a still higher and more rational footing.

We, as manufacturers, are compounding fertilizers according to the best light we have, and the results show that we have made great improvements over the past, enabling the exhausted portions of our country to hold their own against the virgin soils of the West. Nevertheless, we stand at the door of the Experiment Station, with the question: "Tell us something further of chemical economy in plant feeding, that we may still continue to improve the different fertilizers which exhausted nature demands, and must have. Tell us, that we may not fall into error, and involve our capital and mislead our customers." You, as farmers, stand at the same door and ask the same question, that you too may not waste your capital, impoverish your land and fritter away your time, — both seeking knowledge. Shall we have it? That depends upon how liberally the State or the Nation endow and support the Stations already established, how faithfully the work is conducted, and how wisely and patiently we study the results.

Mr. Bowditch. I wish personally to thank Mr. Bowker for one of the most able and instructive papers which I have heard before this Board since I have been a member.

Mr. Myrick of Springfield. The able essay that we have had this afternoon has covered very thoroughly one side of the case; namely, that the plant is the main thing to have in mind in manuring, — that we must feed the plant. Professor Atwater of Connecticut some years ago originated, or was one of the originators of, the theory that we should test our soils and see if there were not some soils on the farm that did not need so much phosphoric acid or potash as others, or some soils that did not need but one of these elements; and Professor Atwater prepared a plan for trying such experiments on a small scale. That idea has come to have a very strong following in this country, because the farmers say, "If we can try experiments on parallel plots with different fertilizers, and see what amount of each will produce the best results, it will save us the expense of putting on all three. If potash or phosphoric acid will produce as large crops as a fertilizer containing both of those elements, and also nitrogen, it will save us the expense of nitrogen, and that means a saving of from five to ten dollars an acre." Mr. Bowker did not cover that point or consider that part of the question at all. I would like to get his opinion upon it.

Mr. Bowker. I would like to ask the gentleman if he really believes in Professor Atwater's theory of testing the soil? I do not think he really believes in it, but I think he has put the question to draw out discussion.

Mr. Myrick. Mr. Bowker, being a Yankee, answers one question by asking another.

Mr. Bowker. I do not believe that farmers can test their soils satisfactorily. They certainly cannot by analysis, and I do not believe they can by raising crops. In the first place, they are not close enough observers. They have not been trained to observe all the conditions. I think that the testing of soils by crops should be left largely to our Experiment Stations. But in this matter of applying fertilizers we must all remember one thing, that the ability of our soil to produce crops (this is a truism, and it is coming out in the years to come) is tested by the minimum quantity of the elements of plant food in it. For example, we may have plenty of nitrogen, plenty of potash and plenty of phosphoric acid, but if the minimum quantity of soda, even, is not present, then all that nitrogen, all that potash, all that phosphoric acid has no value at all. We forget that sometimes; and therefore that is why I feel that in fertilizing our soils we should give them all the leading ingredients of plant food, and then, further than that, we should apply them in the form best suited to the plant, which time will develop. We do not know to-day the forms of plant food best suited to all crops. That is what our Experiment Stations will bring out, we hope. When I think of what we did not know when the Board came here fourteen years ago, what we do know to-day, and what we may know fourteen years hence, with all these Experiment Stations starting up, I can but feel that we are just on the edge of this great field of plant feeding.

Mr. Slade. Dr. Goessmann told us two or three years ago, in an analysis, that asparagus consisted largely of magnesia. We had always considered that the three essentials of plant food were potash, phosphoric acid and nitrogen, and we had the idea that if we put them on asparagus we were all right. Now, inasmuch as it appears that asparagus consists largely of magnesia, is it not fair to suppose that in fertilizing asparagus year after year for twenty years we have exhausted that magnesia, and that the plants need a special application of it?

Mr. Bowker. Yes, sir, I think so. I think if you have been growing asparagus for years in one place you should apply magnesia.

Mr. SLADE. You know a bed lasts a lifetime.

Mr. BOWKER. Yes, sir; but still that does not necessarily disprove the point which I tried to establish in my paper, that certain things were almost specific for certain crops. Magnesia may be essential for asparagus, but I think we should soon learn that certain things have special effects on certain crops; or rather, to put it in another way, that certain crops have a decided taste for certain kinds of plant food. Nitrate of soda, for instance, seems to give a great growth to asparagus, and it seems to be just the thing to apply in the spring. On the other hand, spinach wants sulphate of ammonia. Of course that is not all that is wanted, — you want potash, phosphoric acid and other ingredients present in the soil for that crop; but sulphate of ammonia seems to be just what it wants, — it carries the crop to successful maturity, and that is what we are after in practical agriculture.

Mr. HERSEY of Hingham. I have listened with a great deal of pleasure, and I think with considerable profit, to the paper which has just been read. I believe that the time is coming when we shall fertilize our crops with that fertilizer which is best adapted to them, but I can hardly say that we have got to that period yet. At the present time we are only, as has been said, on the edge of this knowledge, and it is knowledge of the highest importance to all of us who are using commercial fertilizers. I think, however, that our land has much to do with it, after all; that we may go to experts for information and they may give us information in regard to what is best for certain crops, and yet if we should undertake to use the fertilizers they recommend on our land, the condition of our land might be such that they would not prove beneficial at all. I have had some experience in this concentrated fertilizer business, and sometimes have been led astray even by experts, — even by our friend who has given us this very valuable paper. No longer ago than last spring I was in his office, and he recommended, what he recommends here to-day, nitrate of soda for asparagus, and having full faith in his knowledge of the matter, I purchased some nitrate of soda of him; I carried it home and put it on every fourth row of my asparagus, and no man could see through the season one particle of difference between the rows to which it was applied and the others. That shows, that while it might do well on another man's land it would not do well on mine. It shows that every farmer has got to have intelligence of his own. He has got not only to learn what is good for a particular plant, but he has got to learn what his land is deficient in. The farmer, therefore, must place himself on a higher plane than where he now stands if he is to use these fertilizers to the best advantage, and therefore I say to my friend, who, I acknowledge, is far better acquainted with the results of fertilizers than I am, that he must not recommend the use of nitrate of soda for asparagus. He should say, "Possibly your land may have enough of it and may not need it." We have got to take that matter into consideration, for I certainly lost the money which I paid him.

Mr. SLADE. Is there any way by which you can tell whether your land needs it or not?

Mr. HERSEY. I found out last year that it did not need it; I don't know but next year it may need it. You see at once the difficulty. This is an important subject, and it is one which we at the present time do not fully comprehend, and I feel that a large portion of the money which we spend for these things is lost for the want of that knowledge. I have not the least doubt of that. When we fully understand how best to use commercial fertilizers, I think they will be the cheapest things that we can apply to our soil. Of course we must always make use of our stable manure. We shall put that on our farms where it can be applied the easiest, and on those portions of our farms that are at a distance we shall use entirely commercial fertilizers, when we get so we fully understand them. I know men now in Massachusetts who understand them well enough so that they can afford to buy them and use them, and can use them to a profit; but the time is coming when they will use them to still greater profit, and I believe that this paper which we have had here to-day will lead us to inquiry, will inform us of what we did not know before, and will stimulate us to endeavor to obtain a better understanding of this subject, which is, after all, the thing which is going to build up the farming interests of New England in the future.

The CHAIRMAN. Here is a question, and the answer will not take five minutes: "Is it best to remove limbs from pine trees that are from five to eight inches in diameter?" Will Mr. Slade tell us?

Mr. SLADE. I have never had much experience in that. I passed a plantation last week or week before last where the farmer and his men were just finishing trimming the trees, and as I came along he came up and talked with me about it. He wanted to know what I thought of what he was doing. I told him I thought he was doing wrong. He had cut those limbs off close to the tree as high up as he could reach with a narrow axe. I think that those knots will bleed and they will ultimately spoil the lumber.

The CHAIRMAN. If the trees are sufficiently near together will not nature provide for it?

Mr. SLADE. If they are sufficiently near together they will take care of themselves, but in the plantation to which I refer they are not sufficiently near together; they were set eight feet by ten. I think the trimming should be done perhaps the second year. As soon as the tree gets thoroughly rooted take a knife and go through the plantation and cut off the two lower limbs the first year, repeat it perhaps the third year, and so on. The tree will be trimmed gradually, and it will outgrow any injury that it may receive.

Mr. HERSEY. What time of the year would you do it?

Mr. SLADE. I would do it in the spring; take a knife and cut upward. If he had cut them off two or three inches from the butt, I think the limb would have died off and the trunk of the tree would not have been injured.

Mr. HERSEY. They will not be injured at all if cut at this time of the year.

Mr. SLADE. Well, I hope it will not injure them, but I believe it will.

Mr. ROOT of Barre. Do I understand friend Slade to say that he would not remove the small dead limbs from a pine tree?

Mr. SLADE. Oh, no. After a plantation has been set out a year or two you can take off the two lowest limbs one year and the next two the next year, and you will trim the trees so gradually that they will not suffer at all, and by the time the plantation is twelve or fourteen years old it will be trimmed up, perhaps, as high as you could wish. It would reduce the risk by fire to a minimum; the ground would be clear underneath the trees and fire would not be easily communicated.

Mr. Root. There are in many locations large groves of very thrifty pines which have been growing for ten, fifteen or twenty years, and the smaller trees dying out. Every pine tree running up tall and fast has more or less dead limbs. One of the most successful foresters with whom I have been acquainted of late years was with me in a forest of mine, and alluded to that condition of the trees. Says he, "When it comes cold weather take your man and a long pole with an iron hook on the end of it, and go through and break off all those withered limbs; then all the aftergrowth will be clear lumber; whereas, if you leave a little projecting limb, it remains there for years, and all the accumulated growth of subsequent years will encircle that little projection, until it runs almost through the body of the tree. Break it off; nature heals it over, and from that point of the circumference you have clear lumber." That is a point well worthy the attention of every man who owns a forest, in my judgment.

Mr. Fitch. There was one point which came up this morning which I want two minutes to speak of, with regard to reclaiming lands. Everything which has been said since I came here has been said by those who have had practical experience, and I will state mine. "Some years ago I was obliged to use a good many barrels, and I found that I must have round hickory hoops. I found there were very few portions of the country where I could get them in any large quantity, and I also found that I must pay ten or fifteen dollars a thousand for them. Now, I dare say there are some men in this room who have on their farms a piece of land with stones on the sides and which is wet at the bottom. If any of you have such a piece of land, lay aside so many bushels of hickory-nuts or pig-nuts, and early in the spring put them half an inch under ground in this place, planting twenty-five thousand to the acre, as I have done. In four years from that time, if you have taken care of them, you can cut off a thousand or two thousand hoop poles, and the fifth year you ought to be able to cut off from one to two hundred dollars' worth; and if you have any market for such things here, as there is almost anywhere in Massachusetts, for five years from that year you ought to be able to cut off from sixty to one hundred dollars' worth a year. If any of you have an acre or half an acre of such land as that, suppose you try it. It will not hurt the land. Your land is not worth more than five or ten dollars an acre. Plant it in the way I have suggested, and if hoops are worth what they are worth now, I will guarantee that you will be able to get, after the first four years, from sixty to one hundred dollars worth of hickory poles annually from that land.

Mr. Hersey. I want to tell the farmers a great deal better thing. If you want to raise hoop poles or binders for boxes, which are always in demand, take the European basket willow and plant it on your sandy plains, where your land is warm and light, and in three years you will get a good hoop pole. I have them now growing on sandy land, and they have grown nine feet and seven inches in a year. I don't say they will all grow so vigorously as that, but they will grow from five to seven feet in one year. If you are going to make hoop poles, I think you want to take them, the first year after they grow up, and strip the leaves down from the top to the bottom; then you will have a perfectly straight, smooth and clear stalk.

Question. Can you sell those for hoops?

Mr. Hersey. Yes, sir; you can sell them. They make the best of binders for boxes, and they will be just about as large at the top as they are at the bottom. If you don't want to sell them for hoop poles you may sell them the first year for baskets. They are worth in the market to-day about seven cents a pound after they are stripped, and they are a profitable crop. Therefore, I would say to the farmers of Massachusetts, here is an industry which you can take hold of and make a profit on it, if you will first find out whether you have a market.

Mr. Fitch. One word about that. One of the things that are necessary in a hoop that will sell in the market is that it must be of such a character that it will not slip on the barrel easily. I doubt if the basket willow would answer that purpose. For boxes, where the bands are nailed on, I suppose it would answer.

Mr. Hersey. I do not stand in this hall or anywhere else and speak of things I know nothing about. When I speak of the basket willow as adapted to making hoop poles and box binders I speak of what I know.

Secretary Russell. Does it make a good hoop? That is the question.

Mr. Hersey. Yes, sir, it makes a good hoop. I speak of what I know, not what I guess at.

Mr. Burgess. I would like to ask the lecturer one question. I observed that he recommended one thousand pounds per acre for a field of corn. Suppose that the land raises fifty bushels of corn per acre, I would like to ask the gentleman whether, in his judgment, the same amount of fertilizer will raise the same amount of corn on the same land another year, or whether we have got to impoverish our land to feed in part the corn crop?

Mr. Bowker. Back of that question is another. A thousand pounds of a fertilizer such as I described would give eighty pounds of nitrogen, one hundred and twenty pounds of phosphoric acid and eighty pounds of potash. Now, the Stockbridge formula for fifty bushels of corn to the acre calls for sixty-four pounds of nitrogen, seventy-seven pounds of potash and only thirty-one pounds of phosphoric acid; so that this thousand pounds that I have spoken of will furnish plant food for more than fifty bushels of corn; that is, of the three leading ingredients. But I believe in rotation of crops. I do not think it is advisable to plant corn, or any crop, with fertilizers or without fertilizers, continuously on the same soil.

Mr. Burgess. Then it would be evident to my mind, and probably to every mind, that this fertilizer does not feed the crop entirely. Now, I am satisfied, being an old-fashioned farmer, to use barnyard manure wholly. It may be that we cannot raise a corn crop year after year on one piece of land with the use of barnyard manure, but if we can get any fertilizer that will enable us to do it, of course it is sometimes as convenient to use one piece a second year as it is the first. That was why I asked the question.

The CHAIRMAN. I have planted sweet corn for fodder upon the same piece of ground for eight years, and I think I had as heavy a crop this year as I ever had. I put on nothing except stable manure.

Mr. BOWKER. I think that can be done every year, but I think that it is judicious to rotate, not so much because some element in the soil has been exhausted, but because some plants root deeper than others. Corn is a shallow feeder. Follow that with some deep-rooted plant, like clover, and it goes down into the soil and takes up the nitrogen and other plant food which has gone down deeper than the roots of the corn plant. Some crops are conservators of nitrogen, — clover belongs to that class, — and they gather it from the lower strata. That is why I believe in rotation of crops; but you can grow corn year after year on the same land. This gentleman (Mr. Taft) says he knows of a place where corn has been raised for fifty years on the same piece.

Mr. CHEEVER. There is one more reason why corn cannot be raised profitably on the same ground eternally. Every kind of vegetation is liable to some form of disease. Corn smut is a serious pest in many localities and in many fields, and where corn is raised year after year on the same ground, it often becomes very difficult to get a crop on the land; the percentage of smut increases each year. Dr. Sturtevant, I think, found that difficulty in Framingham, in raising corn several years in succession on the same piece.

Mr. GILBERT. In one of our cemeteries there is a large lot of maples that need trimming. At what season of the year should trees of that kind be trimmed, having limbs as large or larger than your arm?

Mr. HILL of Amesbury. My opinion would be, in the fall. Those trees ought not to have been left until the limbs became as large as you speak of before they were removed. I would not remove them all at one time; trim them up gradually. The trees might be trimmed at any time from now to the first of March. I would not cut off too much of the growth, as the check would be too severe.

Secretary RUSSELL. Does Mr. Hill understand that the question is asked about maple trees?

Mr. HILL. Yes.

Secretary RUSSELL. Would you propose to trim maple trees as late as March, where the limbs were four or five inches through?

Mr. HILL. I would not cut off limbs of maple trees that were four or five inches through. I would not cut off limbs as large as that from any shade tree that I wished to preserve any length of time. My experience is that the cutting off of limbs as large as that will materially injure the tree and finally kill it. I would trim those limbs up, leaving the large ones and cutting the laterals. I certainly should not remove them. I would not cut them later than the first of March, and if they were maples, I should rather do it before the first of January.

Mr. UPTON. I have had a little experience in trimming fruit and other trees, and I do not apprehend any trouble from cutting off the limbs of those maples. In a day or two after you have cut them off give the cut two coats of paint, and you will find that the wound will heal over and the wood be just as sound and good as any part of the tree. You will not find any rot there.

Mr. HILL. If I was going to cut them off I would do it two feet from the tree, and instead of using paint I would use shellac.

Adjourned until 7.30.

EVENING SESSION.

The meeting was called to order at the appointed hour by the Chairman, Mr. J. H. GODDARD of Barre, who introduced as the lecturer of the evening Mr. ETHAN BROOKS of West Springfield.

PROGRESSIVE AGRICULTURE.

BY ETHAN BROOKS.

Geology tells us of the ages required that this world might pass through those changes necessary to fit it for the possible abode of man; and the Bible tells us that one of the first commands given to man was, "Subdue the earth." So necessity is laid upon us to be progressive; for only in limited portions of the earth can even a small number be fed from spontaneous productions, much less can they be supplied with those comforts which modern civilization ranks among the necessaries of life.

Man, having originally been placed upon this earth with no tools to work with and with no knowledge of material and methods necessary to make useful tools, with no knowledge of the producing qualities of the earth and of his own necessities, must have been slow, indeed, to devise ways and means for advancement in any direction. From ancient records we learn that man, in his wanderings, found those countries watered by the great rivers of the East to be most productive; and the valleys of the Euphrates, the Tigris and the Nile were made the grain-producing centres, while the hilly regions afforded the pasturage necessary for the support of those flocks and herds then, as now, so essential to the needs and comforts of man.

The beginnings of agriculture are said to be lost in antiquity. We know that at a very early day the storehouses of Egypt furnished supplies to the famine-stricken progenitors of a once mighty nation; and the Greeks are accredited with gaining from their Egyptian neighbors a knowledge of agriculture which made them noted in this department as early as a thousand years before Christ; and, as they advanced in power, they are said to have had fine breeds of cattle, horses, sheep, swine and poultry, improved by extensive importations, while many of their farm implements were constructed on principles adopted at the present day. The Greek farmers utilized those fertilizing materials within their reach, and gave due heed to the importance of drainage and thorough cultivation. They cultivated many of the most valuable fruits known to our climate, — the apple, pear, peach, plum, quince and cherry, with figs, lemons and other fruits suited to their location. But the leaders and rulers of Greece were more anxious to build and adorn beautiful cities than to bring her soil to the highest degree of fertility; so this work was mainly conducted by the unfortunate whom they had subdued from the weaker nations and tribes which surrounded them, and fell into a decline.

With the Romans, agriculture was not only a pride, but a foundation principle. The State apportioned to each citizen a carefully restricted tract of land; and one of their orators said, "He was not to be counted a good citizen, but rather a dangerous man to the State, who could not content himself with seven acres of land."

As Rome by conquest extended her domain, these restrictions were removed, and one might hold fifty, and later five hundred acres. Still they held to the importance of thorough rather than of extensive farming.

Cato the censor, great as an orator, a general and a statesman, is looked upon as having done the best work for his country in writing a book on agriculture, and it is he who says, "Our ancestors regarded it as a great point of husbandry not to have too much land in one farm, for they considered that more profit came from holding little and tilling it well." And Virgil says, "The farmer may praise large estates, but let him cultivate a small one."

We find that following the conquest of Spain by the Moors, early in the eighth century, agriculture in this country received unusual attention, and that, owing to a system of irrigation then adopted, the agricultural resources of Spain were developed to such an extent that the Moors derived from this country an annual revenue of $30,000,000; "a sum," as Gibbon says, "which in the tenth century probably surpassed the united revenues of all the Christian monarchs."

To produce such results required enormous outlay of skill and labor in building reservoirs and artificial watercourses, traces of which still remain. This system was evidently taken westward from Asia and the valley of the Nile, where in very ancient times extensive and very costly works for irrigation were built, exceeding anything of the kind of modern construction.

But whence came that knowledge of the system which the Spaniards, in their conquests upon our own continent, found in use by the ancient inhabitants of Peru, of which Prescott says: "Canals and aqueducts were seen crossing the lowlands in all directions and spreading over the country like a vast net-work, diffusing fertility and beauty around them"?

No doubt the labor of constructing these works was poorly paid, judging from the American standpoint of service and compensation; but is there not here a hint of future possibilities for the New England farmer who for the want of water just at the right time, even for a few days, sometimes loses the labor of a year?

The ágriculture of Spain declined when, upon the expulsion of the Moors by Ferdinand and Isabella and the discovery of America under them by Columbus, gold was rated of more account than grain; so that as one has said, "In the days of Cortez and Pizarro this continent was ransacked for gold from Oregon to Patagonia. The fertile slopes of the Appalachians, the green prairies and rich bottom lands of the Mississippi valley, now supporting tens of millions of prosperous inhabitants, were marked upon the Spanish maps 'lands of no account' (*tierras de ningum provecho*) because they yielded no gold."

Passing over from Spain to England, we find, early in the fifth century, after four hundred years of occupancy by the Romans, a country mainly of forests and marshes, with a people intent, almost from necessity, upon getting a living for the individual without regard to the consequences upon others; with a government so crude and inefficient as to afford little protection to life or property and no encouragement to advancement in agriculture, even if the people had entertained an aspiring thought.

Famines were of frequent occurrence, and farm stock which could thrive during the summer months was so destitute of food and shelter, especially in the northern portion of the island, in winter, that a large proportion, estimated at one-fifth of the whole number in the country, died annually from exposure and want, and a fatal murrain often destroyed still greater numbers.

A few, only, of the standard grains were cultivated, and these in small quantities. Potatoes, squashes, turnips, carrots and cabbages were not known in England till the sixteenth century. In the days of Henry VIII., Queen Catherine was obliged to send to the continent for supplies for her table. The principal food supply of the peasants at this time was bread made of barley, ground in the quern or hand-mill.

In these days the peasants, as tenants of the soil, had no security for their property, being held responsible for the debts of the landlord for an amount equal to their entire possessions. Later, they were held only for the amount of rent actually due from them. Throughout Europe the condition of the peasant (working farmer, we should call him) was no better than in England, — a struggle for mere existence.

We have seen that in Spain and portions of the East much had, in earlier days, been done in certain directions to develop the resources of the soil; but this had been done by such slow and expensive and oppressive methods, — which afterwards, partly, at least, fell into disuse, — and had been confined to such comparatively small sections, that the era of real progress in agriculture can hardly be said to have dawned till the sixteenth century, when Europe awoke from her indefinite drowsiness, and men began to think. From this time onward there has been continued progress, — slow at first, from necessity, but a real uplifting of those classes engaged in agricultural pursuits. In 1523, Sir Anthony Fitzherbert, who prided himself on being "a farmer of forty years' standing," issued the first work on agriculture ever published in England, which he entitled the "Boke of Husbandrie." Following this, the same author issued a volume on land surveying. In touching upon some of the necessities of the farmer of his day, Fitzherbert says, "A housbande cannot thryve by his corne without cattell, nor by his cattell without corne"; and farther he says, "Shepe, in myne opinion, is the most profitablest cattell that any man can have."

This "opinion," coming down to us through three and a half centuries, during which theories have exploded, and on their ashes other theories have risen to explode, entitles the author to a place among the benefactors of his race. From his writings we learn that marl was not only in common use on the island in his day, but was found to have been in use when Britain was invaded by the Romans before the Christian era.

Other writings by different authors appeared from time to time. One work, entitled "Five Hundred Points of Good Husbandry," by Thomas Tusser, appeared in doggerel verse about the middle of the sixteenth century. These volumes were handed down from one generation to another, till they were literally worn out; so that when, in later days, it was sought to issue a new edition, it was difficult to find in one copy the entire work, giving, as was said at the time, "a proof that what was intended for practical use had been sedulously applied to that purpose." Through Tusser we learn that cabbages, turnips and carrots had just been brought to notice as table vegetables.

Closely following Tusser's publications appeared a work which, in our gropings after light, seems by its title to savor a little of conceit, "The Whole Art of Husbandry," by Barnaby Googe. "The Jewel House of Art and Nature," by Sir Hugh Platt, gave the first account we have of the introduction of white clover into England.

Early in the 18th century there came to the front a man whose writings and experiments are justly accredited as "among the first important attempts at real progress in the agriculture of modern times." Jethro Tull ventured upon new methods, and sought to understand the *principles* of agriculture. Without that knowledge of geology and chemistry within our reach, he made some mistakes for others to profit by; but his inquiries and experiments were in the right direction. He invented the horse-hoe and the threshing-machine, and introduced into England from the continent the drill system of cultivation with the drilling-machine, to relieve hand labor. Tull advocated the use of manures, but considered their chief advantage to be mechanical, not realizing that they furnish essential plant food. His theory was that plants are nourished from minute particles of soil; hence he advocated frequent and thorough cultivation, that the soil might be completely pulverized. It was this theory, also, which led him to adopt the drill system in the cultivation of grain, which admits of stirring the soil among the roots of the growing crop.

Tull, like all who are in advance of their age, had few immediate followers; and some who would have been such were obliged to continue in the old paths for want of means to procure the necessary implements, — a want which it may be feared will never be entirely outgrown. The most intelligent and most successful farmers of to-day must give this man credit for wise practices, even if the theories which led to them were somewhat erroneous.

After Tull not much was published of agricultural literature for fifty years, but thoughtful men were at work in various directions. Especial attention was paid in these days to the improvement of the different domestic animals by selection and crossing, and thus bringing blessings to future generations.

Prominent in his day, and deserving of lasting gratitude, was Arthur Young; for it is said that "to him, perhaps, the world is more indebted for the spread of agricultural knowledge than to any other man." He was born in 1741, and died in 1820. He sought by experiment and inquiry to learn the actual cause of the fertility of soil. Hitherto, ammonia had been thought harmful to vegetation! and the wise had insisted that plant food was to be found in acids. Young's experiments with ammonia were always crowned with success.

. He must have been what in our day is called an enthusiast, for he travelled through England, Ireland and portions of the continent seeking light on this all-absorbing subject, and published half a dozen or more works on agriculture. In 1784 he established the periodical, "Annals of Agriculture," to which George III. contributed under the name of Ralph Robinson.

It is here that Young, just a hundred years ago (in 1786), says: "To imagine that we are ever to see agriculture rest on a scientific basis, regulated by just and accurately drawn principles, without the chemical qualities of soils and manures being well understood, is a childish and ignorant supposition."

For the last twenty years or more of his life he was Secretary of the English Board of Agriculture. Scotland, France and Germany in these days made proportionate advances; each learning from others, and each encouraging in itself inquiry and experiment resulting in lasting good.

Coming to our own land, we find our fathers surrounded with difficulties and dangers. And here let us be just to a noble ancestry. That stereotyped phrase, "The beaten tracks of the ancestors," as applied to the early settlers of this land, is a libel on worthy men and women; they were progressive. We do not, cannot see the country as they saw it, — a wilderness with a climate and soils quite unlike those of their nativity.

The obstacles they removed were out of sight before we were born. The bridges we cross with their well-graded approaches have been so familiar to our eyes, that we forget the toil of our ancestors under many difficulties by which these blessings were secured to us.

The thoughtful man who sees more to be done than he can possibly do, aims to do the most important thing first; and in all temporal matters the most important thing is to provide for immediate wants. Thus they were required to provide first, shelter, then food, — as their imported supply would soon be exhausted, — and protection against hostile Indians and wild beasts. They were distant from all outside sources, but were ready in utilizing the resources of this new world. The Indian corn was at once made an article of supply and cultivation for future use.

In the cultivation of those crops introduced from their early homes they had to learn by actual experiment what could be made to be of practical use here. The methods and implements with which they had been familiar were crude and clumsy; stock was poor and the opportunities for improvement were limited in the extreme. The wonder is that they accomplished so much. Theirs was the foundation work, but the visible progress was in store.

In 1747 the first of a series of essays on agricultural topics was published by Jared Eliot, a Connecticut clergyman; but with few exceptions no marked progress was made till after the Revolution, when, having "fought for peace," our fathers were permitted in peace to develop the resources of the land.

The South Carolina Agricultural Society and the Philadelphia Society for the Improvement of Agriculture were established in 1784, and one of the same character had its origin in New York in 1791.

Our own Massachusetts Society for Promoting Agriculture, whose worthy works for almost a century have done credit to its name, and to which the lasting gratitude of all classes in and beyond the old Bay State is due, was organized in 1792.

The British Board of Agriculture dates from 1793, and owes its existence mainly to the efforts of Sir John Sinclair, a Scotchman possessed of an estate of 100,000 acres, on which he delighted to make improvements. Sinclair was the first president of the board, and between him and our own Washington there was carried on a correspondence showing the interest taken by the father of his country in the most vital industry of his race.

The masses were not yet ready for agricultural publications, and it was a great misfortune that "book farming" came to be synonymous with theory in contradiction to practice.

But progress was born, and her breath was in the air. Gradually local societies were organized, holding their annual fairs and bringing together for comparison and information the varied animal and vegetable products of the farm, accompanied by inquiring ones, eager to receive and to give instruction. And now we have in many, if not all, of our States organizations like this one, at whose bidding we are here to-day, seeking continually for new light and best methods, and urging ever to greater achievements.

The printed reports of these societies, including the statements of those who have been successful in special departments and in the cultivation of particular crops, should receive careful perusal as sources of great good.

The first agricultural college in our land was opened to students by the State government of Michigan in 1857, with seven professors and a farm of 676 acres. An act of Congress providing for similar institutions in all our States and

Territories, and setting aside nearly 8,000,000 acres of public lands for endowment of same, was passed in 1862, and the advantages thus offered have largely been seized upon by an eager people.

Our own college at Amherst has now been open for twenty years, and though not receiving the patronage the cause deserves, and laboring sometimes under difficulties, the good to the State at large and to the country from the work of this institution and the Experiment Station connected therewith can only be told when we shall have passed away.

The changes that have come over enlightened lands mainly within the last fifty years are simply marvellous. Chemistry has already done wonders for us, showing the actual needs of animals and plants, and how to supply these needs ; and the names of Liebig and his followers will stand before future generations as suggestive of future possibilities

Lands once considered worn out are now found to be deficient only in certain elements which can be readily and economically supplied, and the common farmer is coming to understand so well the needs of the crops he would raise that he scrutinizes the analysis of any commercial fertilizer offered him, and thanks the State for a law which protects him against fraudulent compounds.

Specialists in various departments, by a persistent determination that knows no defeat, have brought out wonderful truths and laid them as free gifts at our door.

As discovery leads to discovery, and invention to invention, it is safe for us only to assume that progress has just begun.

Variety and Quality of Products.

In ancient times the variety of products was extremely limited, and often when one of these failed there was famine. A terrible illustration of this comes to us from the failure of the potato in Ireland within the memory of this generation.

As we progress we come to depend less on any one article, and so divide the risks of failure. By careful selections and crossings and cultivation we have, as common articles of supply, assortments of fruits and vegetables, — luxuries, indeed, yet so easily produced and so cheaply offered as to place them among the ordinary necessaries of life, and so perfectly adapted to human wants as to be promotive of both bodily health and the higher mental faculties of our nature.

The Northmen who came to our New England shores before the days of Columbus found the grape thriving in neglected freedom; but to Bull and Rogers and our own Captain Moore and other eminent specialists of our day we owe the introduction and development of those luscious varieties which gladden our homes during these autumn and early winter days, while the names of Downing and our own venerable Wilder are suggestive of wonderful possibilities in the fruit department of farm life.

The potato, known to the world only since the days of Columbus, has been slow to come into common use, and two or three bushels were considered a liberal winter supply for an old-fashioned New England family.

Now the annual production of this one crop in our own land can only be reckoned by hundreds of millions of bushels, while its use for food has become more general on the tables of the rich and the poor than that of almost any other article.

Indian corn certainly had no place among the stores of those who had never heard of this new world. In our times it proves the one crop suited to our broad lands.

Farm Stock.

The ancients had their flocks and herds, furnishing material for clothing, dairy product and a meat supply; and to these they were largely indebted for subsistence. It was left for the men of our day to devise and place within the reach of the common farmer those appliances which revolutionize the dairy business, and give to the world a quality of product never before known, while improvements in dairy and other farm stock, through efforts on the part of specialists that amount to patriotism, have fully kept pace with those in kindred departments.

With the aid of chemistry we are able to balance up the feed of the domestic animal, making each part take its proportionate place; and the knowledge and skill of the veterinarian give us untold advantages over those of earlier days.

Implements.

From the coming of man bare-handed into the world, and groping through centuries with a small supply of the most unwieldy implements, — seemingly devised to produce the smallest results at the greatest outlay of human muscular effort, — we have machinery to do much of our work, enabling the farmer and his family to accomplish vastly more than formerly, and relieving us of much of the hardship which our fathers and mothers endured.

The ancient plow is supposed to have been a crooked stick, drawn by the hand of man. This implement has passed through varied changes till we have in the varieties offered us plows suited to all lands and conditions, and which, in skilful hands, with less horse power than the older plow required, will lay an unbroken furrow in almost any soil. It would require too much time to speak of the wonderful improvements made in the department of implements in the last thirty years.

Improvement in Lands.

Well-cultivated farms are gradually becoming more productive. An intermixing of soils, of which we have a wonderful variety, is often done at trifling expense and to great advantage. Lands once quite useless, and often considered malarious, have, by drainage and cultivation, become our most productive fields. The cultivation of the cranberry alone has added hundreds of thousands of dollars to the valuation of our Atlantic States, affording light and remunerative employment to many who are not able to engage in heavier work, and giving to the cultivator most satisfactory returns for his investments.

Long-cultivated lands, in the Old World and in the New, under the light of modern discoveries and with better treatment, have largely increased their product per acre. It has been estimated by the highest authority of that day that in the eleventh century the average yield of wheat per acre was only six bushels; and we have the statement that "in 1390 one field of 57 acres produced only 366 bushels, and but little more than this on an average of three years." The report of the Commission of Agriculture for 1882 shows the average of wheat in Vermont and Massachusetts to have been a fraction over 17 bushels per acre; in Connecticut, 20 bushels; in New York, Pennsylvania and other of the larger States, about 15 bushels per acre.

During the first half of the present century the population of England increased 7,000,000, and the production of wheat in that country increased in the same time to an amount equal to the demands of the people.

Not many years ago it was claimed by certain enthusiasts that we had only to resort to deep plowing to find "a farm under a farm." If this be not altogether true, it is proven beyond doubt that there are farms within our farms awaiting development. The most enthusiastic farmer can hardly fix a limit to the amount of valuable produce that can be grown on a given quantity of ground. By a careful study of the nature of different plants, and a force of application, we may often secure two and sometimes three crops in one season rial and from the same ground.

Demands and Possibilities of the Future.

Down through the ages, notwithstanding the divine injunction, "Love thy neighbor as thyself," man has spent his energies largely in subduing his fellow-man, — who, after all, will not stay subdued. Let us hope that in the era of progress now upon us we may learn the importance and the beauty of complying with that early command, "Subdue the earth," and we may faintly imagine some of the possible results. We shall learn to utilize more perfectly the material and forces at our command.

As the manufacturer utilizes the forces of nature when he turns water on to his wheels, and confines steam that it may do his bidding, so the farmer must utilize the gathering, digesting and assimilating powers of the various domestic animals and the forces of gravitation in drainage and irrigation.

We must learn and *remember* that the difference between about right and just right may be the difference between success and failure, and that we have to contend with sharp competition and constantly varying circumstances. None the less does this require thought, because from the early days of man this has been one of his chief employments.

Our ancestors could not, from the nature of their surroundings, have lived as we live; to have undertaken it would have been wrong. In our day and with our advantages, it would be wrong for this generation to live as did those who preceded us. "New times demand new measures."

Some things long held in doubt are already settled, while some important matters are still in dispute; and possibly others which may yet prove of great interest have not received a passing thought.

Progressive agriculture means, not necessarily a growing bank account or heavy assets for executors and administrators, but more comforts to the world, because of more knowledge and an awakened desire for other possibilities.

An ethnologist of ability, Mr. Charles Pickering, has maintained that "the history of the progress of mankind can be distinctly traced to the extension of the areas of cultivated plants."

Progressive agriculture means a love for, and a faith and a delight in, the work which will make the farmer in his employment the most contented and therefore the happiest of men.

He of all men is most likely to be blessed with an answer to that wonderful prayer of old, "Give me neither poverty nor riches," — a condition which will enable him to look soberly and candidly upon the realities of life, while he remembers that "as for the earth, out of it cometh bread."

The quantity, the quality, the variety and the cost of bread are dependent under certain laws of nature upon the energy, the skill and the wisdom of the agriculturist.

> "Seize upon truth where'er 'tis found,
> On Christian or on heathen ground;
> The flower 's divine where'er it grows;
> Neglect the prickle and assume the rose."

The CHAIRMAN. We have all been pleased with this lecture to which we have listened, and it abounds in suggestions for discussion, which I hope will follow. There are many gentlemen here who are able to speak on the subject.

Mr. Root. I do not rise to make any remarks. I know that this audience have been charmed and instructed by the admirable lecture to which we have listened, and I rise simply to suggest that the Chairman call upon a gentleman whom I notice in the audience; a gentleman whose wide observation and experience in carrying on experiments both in this State and the State of New York, in positions of high responsibility, abundantly fit him to speak on this occasion; a gentleman who has been selected by the Board of Trustees of your Agricultural College to preside over an important department, that of agriculture, and to guide our youth and stimulate them to the acquisition of a thorough knowledge of progressive, scientific agriculture. I refer to Professor Alvord of the Massachusetts Agricultural College.

The Chairman. The audience will be pleased to listen to Major Alvord.

Major Alvord. Mr. Chairman, ladies and gentlemen, — This is a very unexpected call to me. Naturally enough I took this opportunity to again be present at a meeting of the Massachusetts Board, and while I might have joined in any discussion arising after the entertaining paper which we have heard, I confess to being a good deal staggered by the introduction with which I am called forward at this time.

Perhaps nothing can be more appropriate in following the paper that we have just heard read with so much pleasure and profit, than to take up a suggestion of the writer and enlarge briefly upon it; namely, considering the plow as an illustration of the progressive agriculture of the world.

I believe that our first recorded history is in the form of sculptures upon ancient tombs and monuments in Asia Minor and Egypt. In Asia Minor an ancient slab has been found, which probably dates back between 3,500 and 4,000 years, and shows the plow in the form which has been mentioned, of a crooked stick, managed by six men. The plow then consisted of the essential parts which we recognize to-day. The plow-beam was long, extending upwards at a sharp angle so as to rest upon the shoulders of the two leaders of the four-man team. About half-way down the beam the other two men grasped it by hand. It turned at the junction of the beam and the share, and there had two handles attached, which were managed by two other men, one on each. The share was simply a stick which projected into the ground, through which pegs were driven, so that the men could assist with their feet in forcing the point into the ground, as well as use the handles. When it was desired to raise the point from the ground somewhat, the leaders of the team slipped back under the beam, raising the point, and therefore lifting the share out of the ground, on the principle of the lever.

The first record of a team of animals used in the operation of plowing comes later, on Theban tombs. There I believe the plow was essentially in the same form, but it seems that when they began to use cattle for drawing it they considered one handle as sufficient, and the person who guided the plow with one hand sometimes sowed the grain with the other. Some of their representations indicate that the sower of the seed preceded the cattle, sowed in advance of them, and the plow was used largely for covering the seed. Other representations give us a third person, whose duty it seemed to be to make noises and gesticulations, which have been interpreted as intended (and that is indicated also by engravings) to scare away birds and distract their attention, so that they should not see that seed was being put into the ground. Here again, with the oxen, the beam was long, projecting above their heads, and lashed to a plain stick, that in turn was fastened across in front of the horns of the cattle. The plow itself at that time appears not to have been changed in form. It was of wood and the share a forked stick. From that time there was little change or modification for a long series of years. Two handles were substituted for one, and the share itself appears to have been changed somewhat in form, applying the principle of the wedge; but except in the recognition of the lever in the construction of the plow itself, there seems to have been no essential change. This application of the wedge in raising the earth, making a chisel edge of the share, so that it simply raised the earth vertically, upon the principle of the wedge, appears to have been the second application of mechanics to agricultural implements. In this form, which dates back to between 1,700 and 1,800 years before Christ, the plow comes down to the time when we get the first written history of agricultural implements; and I suppose we may consider the earliest to be that of the Greek writer Hesiod, between seven and eight hundred years before Christ. He describes the plow very minutely, and he also gives us, after the Greek style, something of its origin.

You know the Greeks had legends to account for almost everything, and among them was one as to the origin of the plow. The daughter of Saturn and Rhea — the goddess and guardian of agriculture — was Ceres, who needs no introduction to an audience so largely of The Grange. Ceres had a daughter, Proserpine, a likely maiden, and it is easily understood that while duly considerate and affectionate, the worthy goddess looked forward with great satisfaction to the time when her daughter should relieve her from household cares. But like so many mothers, Ceres was doomed to disappointment. One day while Proserpine was gathering flowers in the fields of Enna, Pluto came and carried her away to be the queen of the lower regions. Ceres was disconsolate over the loss of her daughter, and vainly wandered about in search of her, and neglected her duties; so the harvests failed and the earth was in danger of becoming barren. Jupiter and all the gods besought her to give up the search and return to Olympus; but she would not. Finally the gods succeeded in persuading Pluto to allow Proserpine to revisit the upper world and remain with her mother two-thirds of the year, or during the growing season, and then she was to spend the winter with her husband in — a warmer climate. Ceres was appeased by this arrangement, and consented to return to Olympus. She was then in Eleusis, and before leaving, as a parting gift to her host, Triptolemus, she taught him the art of agriculture. Triptolemus learned fast, and under the inspiration of Ceres he invented the plow. So that we have the plow represented as, indirectly, the gift of the goddess Ceres.

Now, whatever reliance may be placed upon a legend existing in those days, there is no doubt of the reverence which the ancients paid to all of their mythological gods and to all the things which they regarded as gifts from them; and I think we may fairly suppose that the fact that the ancient Greeks and Romans, believing that the plow was a gift from the gods, and dreading, as they did, the enmity of any of the gods, and especially of the goddess Ceres, so important to their material welfare, hesitated for this reason in making even such changes as might occur to them as desirable in the plow. This is a reasonable supposition, I say. At all events, from the time Hesiod wrote, seven or eight hundred years before Christ, until Virgil wrote, just about the time of the Christian era, there seems to have been absolutely no change. The written descriptions of the plow as it was then used, one in Greek and the other in Latin, are almost identical. And for a long time after that we find substantially no progress in the development of the plow. It appears that they did change the use of the principle of the wedge; for whereas, in the time of Virgil, the wedge ran horizontally and simply raised the earth, loosening it and dropping it substantially where it was before, the wedge was turned on edge along somewhere in the Dark Ages, when we have very little record; and when the plow reappeared, as described about the time of William the Conqueror, the wedge was set up on edge, so that the earth was thrown sometimes one side, sometimes the other, according as the plow was used, for they do not seem to have made much distinction between a right and left hand plow, according to the illustrations that are given.

Then again, we have old calendars of somewhere in the eleventh century still in existence, which give rough representations of the plow, and there for the first time appears the coulter. So we may date that improvement from that time. It is about 700 years since the coulter first appeared attached to a plow. Very nearly at that time wheels were used for guiding the plow. The wheels preceded the plow, and instead of the implement being guided directly by the animals at the head of the team, it was guided by these wheels. The animals were harnessed with long strips and traces, which are described in some cases as being made of the skin of whales, and the traces were attached to the axle, and drew directly from it. The wheels were small, and the beam of the plow was lashed to the centre of this axle. The wheels assisted in some degree in the draught and in regulating the depth of the plowing. At this time it is found that the shape of the plow was, as I said, sometimes a horizontal wedge and sometimes a vertical wedge, but still no indication of any idea of combining the two wedges in anything like a twist form.

Then about the fifteenth century we find later illustrations of the plow, when something like a mould-board first appears, protected with strips of iron or brass and a metallic point, the pieces of metal attached to the wood simply to preserve it from wearing so rapidly. At this time, in the fifteenth century, is the first we see of anything of the mould-board character that would turn a furrow at all, or that would give width to the furrow. Several forms of mould-board then appeared, one of which is of a diamond shape, with one of the acute angles pointed downward, shod with iron, the sides turning upward; and the earth by this means was raised from the ground, on the principle of the wedge, carried upward and separated on either side of the standard. Then, as the plow moved along, the earth was thrown back, separated by the standard and dropped over the back part of this mould-board, pulverizing it by this process better than any plow had done before that time, and dropping it in the same furrow from which it was removed. Another mould-board appears about the same time which has the idea of a double wedge, and it carried the earth well to the right, leaving the passage clear for the next furrow. There are plows now in the museum of the New York State Agricultural Society in Albany that answer perfectly the description of the plow of the year 1100 and the year 1500, as we have them recorded in the old manuscripts of Great Britain; and there are plows there that came from the south of France, Greece and Albania, that are believed to be, and no doubt are, from three to four hundred years old, and which answer this description perfectly; and duplicates of those plows can be found still in use in parts of Spain, France and Italy.

The next step in the progress of the plow was within one hundred years of the present time, in the time of Tull and Sinclair, although Tull can hardly be set down as one of the persons to whom we are indebted for the advance of the plow. There was a plow that came into England from Holland in 1750, known as the "Rotherham," — probably a corruption of Rotterdam, — and that is really the basis of all the progress that has been made in the plow in England and Scotland for the last hundred years. That had a pretty fair mould-board; it had two handles and a clevis, — the latter used for the first time just about one hundred years ago. To that plow Tull devoted his best energies, thinking that by developing it he would do a great deal to assist husbandry. He attached wheels to the truck which were five or six feet in diameter, and there was a very clumsy system of chains, drawing something like the ordinary draught, but not exactly like that of the present day. That was the only redeeming feature of his improvement; but it was a very cumbersome affair, requiring five or six oxen to draw it, and the wheels were both alike, no provision being made for the fact that one wheel was to run over soft ground, and perhaps in a furrow. We cannot thank Tull much for improving the plow.

But I have said enough about England. We are not very much interested in that. In the last hundred years we have got ahead of them very fast in this country. I want to call attention to the fact that the first person we can find who took a particular interest in developing the plow upon scientific principles was Thomas Jefferson of Virginia, who, while he was Washington's minister to France, is found by his note-book making a record of the unscientific and impracticable character of the plows which he saw used by the peasants in France; and in that note-book, afterward published, we find the idea first expressed of making the mould-board on the principle of the twist, which is the recognized principle of the correct mould-board of the present day. Jefferson submitted two papers to eminent scientific societies upon the construction of the plow before he returned to America, and he stands to-day, in France and Great Britain, as the author of the first plow made upon scientific principles. He made plows after his own pattern upon returning to this country, and was one of the first, also, to have the entire mould-board made of iron, if not the first. Probably he was the first in this country. We all know the interest that Webster took in the plow and in the history of the plow. Daniel Webster stands, perhaps, in this country next to Jefferson, as being the one to whom we are indebted for great strides in the development and progress of the plow.

Then, coming to more recent years, it is within the memory of all of us here that one of the successful plows in the present generation is the invention of Governor Holbrook, who, perhaps, perfected the geometrical demonstration of the construction of mould-boards, so that any number of plows could be made of a given size for a given purpose, and they would all be alike. So we see in the progress of agriculture, as illustrated by the plow, some of our most eminent American statesmen — men whom we would hardly expect to devote their time and talents to this purpose — doing for us a very great service.

I think that we must all recognize the plow as the most important implement of agriculture. The stirring of the soil and the operation of pulverization by the use of a single implement lies at the basis of all our agricultural industry, and the plow therefore is our most important implement. I thought it was as good an example as I could take to follow up the very interesting paper with which Mr. Brooks has opened this discussion.

The CHAIRMAN. Has any other gentleman any remarks to offer on this subject, or is there any one whom you desire to hear? If you will name him, I will call him out.

Mr. HOUGHTON. I suppose this is about the last time we shall have an opportunity to hear from our Secretary. You know, Mr. Chairman, that everybody likes to hear him. [Applause.]

Secretary RUSSELL. Mr. Chairman, ladies and gentlemen, — I think it is rather unkind in my good friend from Sutton to remind you and me that this is probably one of the last times that I shall have the pleasure of standing before these assemblies.

Mr. HOUGHTON. You are going up higher. That is what I had in mind.

Secretary RUSSELL. No, sir; nobody rises from agriculture. Men boast of going higher when they become placemen or politicians, but it is not a rise. The noblest pursuit of man is reached when one is an independent tiller of the soil [applause], and it is a matter of great regret in my mind to-night that this is the last evening that I shall occupy this official position as the head of the Board of Agriculture of Massachusetts. I have no fitting words for this occasion; but I hope that the man who follows me will have the same earnestness of feeling and the same pride in his position that I have had, and will enjoy the same delightful and friendly relations that I have had with the agricultural interests of Massachusetts. If he does, his life will be a happy one, and when he resigns his office it will be with as much pain at parting as I feel to-night.

The Chairman. Perhaps we had better now adjourn.

Adjourned until Thursday, at 9.30.

THIRD DAY.

The meeting was called to order at 9.30 by Mr. Goddard.

The Chairman. I have the pleasure to announce a lecture by Mr. Edward Burnett of Southborough.

SWINE FOR THE HOME MARKET.

BY EDWARD BURNETT OF SOUTHBOROUGH.

Gentlemen and Fellow-Farmers,—The origin of the modern pig dates back only about a century, and the first cross towards the remarkable improvement brought about during this period was undoubtedly made by the introduction of the Chinese and Siamese blood.

From what I have read in the various English authorities on this subject and from old wood-cuts, this Chinese pig, either white, spotted or black, was of medium size, with rather a short face, large, coarse body, and smallish bones. This animal fattened rapidly, but the flesh was inclined to be soft and flabby and always very thick on the belly. The cross, by a survival of the fittest and fresh importations extending over a period of many years, founded the thoroughbred families of to-day, — the Yorkshire, Berkshire, Essex and other well-known English strains.

Few people realize what good work these early English breeders did, and how much the whole civilized world is indebted to them for their great efforts in the improvement of all our domestic animals, especially those for beef, mutton and pork. They reduced the cost of actual production at least one-half. I find in Pearce's "History of Berkshire," published in 1794, that, speaking of the hogs, he says: "They are the long-eared kind, having long legs, high, narrow backs and low shoulders; they are slow feeders, and require good meals to keep them even in tolerable condition." Contrast this description with the Berkshire of to-day.

Lord Weston in 1834 made a violent outcross, and by importing from Italy some black Neapolitan boars founded the Berkshire and Essex families; and Fisher Hobbs, a tenant farmer of his, continuing this cross, devoted a lifetime to improving and establishing these two breeds.

Lord Ducie, on the other hand, did much for the white breeds, and to his skill is largely due the improved Yorkshire of to-day, which is in my opinion the most perfect modern specimen of the porcine family.

In our own country I find that the farmers began to improve their swine about the beginning of the present century, and to the sea-captains of our merchant marine, and a few wealthy gentlemen in Philadelphia, New York and Boston, was largely due the infusion of fresh and improved blood. Chinese pigs were the first imported, and from some of these animals, bought in Philadelphia by the Quakers of Butler County, Ohio, originated the once famous Magic breed; and this stock, in turn crossed with an imported Berkshire boar, produced the Poland China, a breed to-day more commonly found among the large farmers, especially in the West, than any other. The Chester Whites, another American family, originated about fifty years ago, in Chester County, Pennsylvania. It received its first cross from English white stock, and is found quite extensively among the Eastern farmers. The originators of this breed boast of their never having made any but the original cross. I think, however, the infusion of some first-class Yorkshire and Suffolk blood into New England has, during the past quarter of a century, greatly improved the originals.

These so-called American breeds, in my opinion, are not *true thoroughbreds*, and this opinion has been formed by personal observation at the State Fairs, not only here in the East, but throughout the West.

I have always found a marked difference in the same litters; among the Poland Chinas, some pigs with the long, sugar-loaf head of the old-fashioned Magic type, and others with the short-dished face of the thoroughbred Berkshire. Among the Chester Whites in the same litters I have found the drooping ear, with a sort of teat on the under side, coarse bones and crooked legs, the early characteristics of this breed, and with these same pigs the finer, shorter head and clean limbs of the Yorkshire or Suffolk.

The definition of a thoroughbred is when "like begets like, or the likeness of some ancestor;" and how clearly this is found in the modern English breeds, every pig in the litter having the characteristics, and only the characteristics, of its distinct family, even to the markings of the bristles. I fully appreciate that I am casting a bomb into the camp of our American breeders; but I will stand my ground. In Greenfield, a few years ago, when talking on this same subject before a farmers' institute, the farmers objected to this assertion of mine, but proved it, to my great satisfaction, soon afterwards by admitting that their present Chester Whites were no more like the original parent stock, brought twenty-five years ago from Chester County, than the improved shorthorn steer is like the coarse ox found to-day on some of our New England farms. Among the English farmers, a few men — generally of wealth, and always with great intelligence and perseverance — make the developing of a breed a life study.

I find Mr. Sanford Howard's paper on "Swine," published in the Report of our State Board of Agriculture in 1853, by our late secretary, Mr. Flint, most complete and interesting. He speaks of Capt. John Mackay, a wealthy sea-captain and ship-owner of Boston, who brought pigs on his ships from all parts of the world, beginning in 1830. He did a great deal to improve our stock, and a breed called the Mackay breed was soon well known throughout New England and the Middle States. These pigs, although a great improvement, varied very much in size and shape, as one might naturally suppose.

The Stickneys, William and Josiah, imported, from 1842 to 1848, a number of the improved Suffolk, and created a great demand for this stock throughout the country; and the effects of this importation are found to-day in many a New England pen.

Later, the old Massachusetts Society for Promoting Agriculture, always ready to lend a generous hand to improve the condition of our common farm-stock, imported Berkshires, Essex and Yorkshires, selected from the best pens in England, and from time to time has distributed them throughout the State.

The question of to-day is, What pig is the most profitable for us to breed for our home market? This can be easily answered by saying, That pig which in the shortest space of time on a given amount of food will produce the most pork.

Our market has changed, even in my day, very greatly. Formerly, the packers wanted a large hog, weighing from 400 to 600 pounds, from one to two years old, and paid the highest price for such pork. To-day, these same buyers want pigs weighing from 200 to 300 pounds, and prefer those not over ten months old.

Compare a grade shorthorn steer of to-day, with its almost perfect symmetry and small amount of waste, to the beef animal of fifty years ago, and what do we find by the comparison? In the former, as much beef at two years of age and of much better quality than in the latter at four years of age. Similar results are obtained with our best grade pigs, for we get as much pork in eight months as we formerly did in twelve.

Nearly all writers on this subject agree that for the ordinary farmer, with his usual facilities for fattening pigs, a thoroughbred boar of small bone, with a short nose and of early maturity, crossed in sows that have plenty of constitution, and that might, perhaps, be considered a little coarse, produce the best average results. I have followed this practice myself, and will give you the results of my experience.

My first boar was an Essex, and his pigs were most satisfactory, maturing early, docile and easily fattened. At the bench, in cutting up, I found the strips for the barrel of fine quality and very thick; but the belly stock, which I put into bacon, was heavy and too fat. The hams were very large and the fresh meat a little dark.

My next purchase was a Yorkshire boar, and I was much pleased with the results; pigs were most easily kept and always fat. I obtained the whitest and best loins and spare-ribs for the market, a firm and thin-rind pork for salting down, but a belly strip that was just the reverse of the Essex grades, — too light and thin.

My next boar was a Berkshire, and, with the exception of the bacon and hams, which were almost perfect, I found these pigs did not fatten as easily and were inclined to be restless.

After many experiments, I should select to-day for my special business strong, hearty, grade Yorkshire sows and cross with the Berkshire boar, or the reverse, when they are almost sure to be white.

Pigs, like all domestic animals, require plenty of good feed, fed regularly, clean quarters and proper care. Without either one of these requirements, no matter how good stock a farmer may have to begin with, he will not be successful and his stock will soon begin to deteriorate. No other animals require greater skill in in-and-in breeding than pigs, and for the ordinary farmer fresh blood every few years is indispensable.

Nothing should be bred under a year old, and experience has taught me that a well-shaped sow that throws large litters and is a good mother can be kept to advantage eight or nine years. The flow of milk increases up to four years, and will hold as long as she continues to be a good feeder.

There is, perhaps, more skill in feeding swine than any of our domestic animals, and I have frequently found that one man would make pigs thrive on a certain amount of feed, on which with another they would hardly hold their own.

There is nothing like skim milk for young pigs, and yet it cannot be fed profitably for any length of time at over half a cent a quart.

As a substitute, I have used to advantage good bran and crushed oats scalded so as to make a thin mush. After the third month some meal can be added, and gradually increased until it takes the place entirely of the bran and constitutes three-fourths of the grain feed. With spring pigs this feed of grain can be supplemented by one feed a day of green fodder; freshly-cut clover being the best of all. Young pigs should be fed three times a day. Some of the farmers that supply me with pork have been most successful in turning weaned pigs out to clover, and feeding only a small ration of skim milk or slops once a day, continuing this until six weeks before marketing, and then finishing off in close pens, kept clean, with corn meal and whole corn.

One litter of sixteen, by a Berkshire boar out of a very good Chester White sow, raised in this way by Mr. Childs of East Thetford, Vermont, only cost the owner $35 for grain, and at six months and a few days averaged over 250 pounds, dress weight. Mr. Childs, I may add, was a skilful feeder. A neighbor of mine in Southborough last season obtained almost similar results with eleven pigs, very high grade Berkshires. He cut his clover from an old garden patch and fed daily in a large, dry pen. Four crops of clover were cut off the same grounds during the season, and I never saw finer pigs of their age than these. They averaged 208 pounds, dress weight, at less than six months.

The anatomy of the pig resembles very closely that of man. The stomach is very small, but they have great power of assimilating food, and if fed properly will put on flesh very rapidly. Originally a herbivorous animal, the modern pig requires more or less condensed and nitrogenous food, and the latter explains the value of clover. A good illustration of the great improvement in the modern pig and of the small amount of waste, is an experiment tried in England a few years ago. A thoroughbred Yorkshire, about twelve months old, that dressed over 600 pounds, was carefully dissected, and the bones, cleansed, weighed only 21 pounds.

One important question I have not touched upon, and that is the comparative value of cooked and uncooked food for pigs. I am well aware that on this subject there is a great difference of opinion. I personally think localities best determine this disputed point, and that you all will agree with me that here in New England the majority of our best farmers scald or cook their pig feed.

During the past two or three years, especially, the whole country has seriously felt the scourge of hog cholera, which has swept off large numbers of pigs From recent reports by Dr. F. S. Billings, received from the State Experiment Station of Nebraska, I find that he hopes to prove shortly that by inoculation this dread disease may be averted. If this can be brought about, it will certainly be a great stride in the advancement of veterinary science and demand public recognition.

In conclusion, let me add that I have purposely made this paper short, and have endeavored to throw out assertions enough to create a lively discussion, and am now ready, gentlemen, to defend my position.

The CHAIRMAN. Gentlemen, I think you will all agree that although this paper is short, it is packed as full of meat as any animal you ever saw; and now there is opportunity and time for discussion, which I expect will be fully improved. At a fair in this town last fall, those who were present and looked over the stock noticed some remarkably fat and clean-looking pigs, and I will ask Dr. Charles G. Allen to tell you how those pigs were raised, fed and cared for, and anything else that he chooses to say about pigs will be in order. I am glad to know that there is such a similarity between the human race and pigs; I did not know it before. I see it is now demonstrated scientifically.

Dr. ALLEN. This matter of raising pigs and pork is one which interests me, and always has, very much. Unlike most people, I have said that I liked my hogs much better than my horse. I like to take care of them better than a horse. I take better care of them, because I like tending them better. There are a few things which are essential, in my opinion, to success in raising pork. One of those things is that the pig shall be kept comfortable, shall be kept dry. The opinion that they like to wallow in the mud and enjoy filth is not well founded. Pigs like to be neat and clean much better than some of their owners do, and, if they are properly tended, will keep their pen clean much better than any other animal I know of. I do not know of any other animals that I have had the care of, that of their own accord, if they have fair facilities, will make their nest and keep it so clean, keep it in such good shape, as a well-trained and well-behaved pig will.

Last fall I was looking for some pigs to keep under my barn during the winter, and going to one of my neighbors I saw some pigs which were in as bad a condition as one could well imagine. They were probably five or six weeks old, apparently of the Yorkshire breed. I bought the four for five dollars. I did not want them, and took them more out of pity than anything else; but I thought I would like to try such specimens and see what could be done with them. I put them into my stable, which can be kept very warm; I gave them dry litter, and if any creature ever seemed to be thankful for a warm place those little fellows did. They were completely covered when we went out to feed them. The essayist says a pig should be fed three times a day. In my opinion small pigs should be fed at least five times a day. If they are fed only three times a day and allowed to have what they really need, I think they will eat too much. I agree perfectly with the essayist that nothing is so good for small pigs as skim milk, but after they have left the sow I feed them a little bran, or bran and oats ground together. I have been told that common middlings are better than bran, but I have been satisfied myself with oats and bran. I found that one of these four pigs was so much of an underling with the others that he was in the habit, when he got a chance, of eating too much and did not do well, and I made a present of that pig to a man, with the understanding that I should receive a dollar for the pig. That left the cost of my three pigs four dollars. I kept them from some time in November until March. They cost me twenty-two dollars and a few cents. I sold them in March for thirty-eight dollars and some cents. I was well satisfied with the operation.

Those pigs had good care, good feed, and all they wanted to eat. If I remember correctly, the best one of the lot weighed about two hundred and fifty pounds.

The eleven pigs of which the Chairman spoke as having been seen at the fair were raised part by myself. Those which I raised were grade Chester County. I kept them from the 12th of April until the 1st of December, — some seven or eight months. Those that I have raised myself, dressed from 250 to 325 pounds when about eight months old; the others weighed from 200 to 240 pounds. The pigs which I bought were as nearly starved as pigs could well be. Almost up to the time I killed them, no matter how much they had in the trough, they would fight and push each other from one end of the trough to the other, and waste about as much as they ate. They got into that habit when they were small, and they were always squealing and fighting when anything was put into their trough until the last month or two, when they got so lazy that they did not care to fight. But I believe that a young pig, if kept warm and clean, and having all he wants to eat, is no more inclined to fight than the human family, which they have been said to so closely resemble.

I think pigs do better when three or four are kept together than when kept singly; I think company rather stimulates them, and they take hold and eat better than when alone.

The general idea seems to be that pigs can stand any amount of cold. Their pen is generally in as cold a place as you can find about a farm, and no care is taken to protect them from the cold. Now, every animal is kept warm either by what he eats or by artificial heat, and the food fed to pigs in such cold and uncomfortable quarters as they are usually kept in is about thrown away. I think they should be kept warm, and the nest where they sleep should be as close as possible. In warm weather their quarters should be well ventilated. I like best for bedding the brakes which we find about our pastures, which makes a very fine straw. I do not like to use rye straw, it is too valuable.

I think the pig is very useful as a manure manufacturer. I found my farm not as fertile as I wanted it; I could not afford to buy fertilizers, and I am trying to get it back into condition by keeping pigs.

QUESTION. Will Mr. Burnett tell us the difference between ham and bacon? I think many of our farmers confound the two things.

MR. BURNETT. I hardly know how to define the difference; "ham" means the leg with me. They make bacon of the sides in the South and in England, but they use there what they call a "grazer." Those are generally herbivorous animals. They live on acorns, grass and whatever they can pick up in the South, and are what we call "racers." They are of good size, large frame, but the hams are lean; and they cure the whole sides, and, in fact, the whole back goes into bacon. With me, "bacon" is the belly-strip. It is not the belly-strip that you generally see: it is trimmed, and it begins upon the back; two or three inches of the lower part of that strip is cut off. The pieces that go into my little packages of fifteen and twenty-five pounds are only six or eight inches long, and what I call "bacon" is all the rest of the side. These strips are cured by the dry process, by rubbing in salt. It takes four or five weeks to convert the meat into bacon, and these bacon strips cost me a great deal more than any other pork that I pack.

MR. MYRICK. How do you cure your hams?

MR. BURNETT. That is something I would not like to tell you unless I can be persuaded that it will be for my pecuniary advantage. It has cost me a good many dollars to find out how to do it. You seem to forget that I have a good friend here who is also in the pork business.

MR. WILLIAMS. I wish you would press the question as hard as you can. [Laughter.]

MR. BURNETT. I suppose he would give a thousand dollars to know how I cure my hams. I will simply say this: I do not cure my hams by dry salting. They are rubbed for ten days and then packed in pickle from four to six weeks. I will say this, gentlemen, about curing hams, and it is from experience, because for many years I did every part of my pork business myself, up to the extent of 150 pigs a year. I packed my own pork, cured my hams and tried my lard with my own hands. I have found out from personal experience that to cure a ham and do it well you must have an even temperature, and for that reason all the large packers watch the temperature of their bacon and ham rooms as carefully as you would watch the temperature of your dairy room in which you make your butter in summer. It is the most indispensable point in curing hams to have an even temperature. You cannot cure them where the temperature is below zero one day and the next is up to sixty or seventy degrees.

QUESTION. You do not put your bacon in brine at all?

Mr. BURNETT. No, sir, I do not.

QUESTION. What temperature do you allow?

Mr. BURNETT. I should say between sixty and seventy degrees.

Mr. BILL. I was in Bristol County a few weeks since, and a prominent agriculturist there was talking about the pork market, and referred to Mr. Burnett's raising pork. He said to me, "You would hardly credit, Mr. Bill, that Mr. Burnett's sale of pork amounts to some $80,000 a year?" I said, "No, sir; I would not credit it." Now, we are face to face to-day with Mr. Burnett, and perhaps it would not be just the thing to say I do not credit it, but I would like to ask him if he raises upon his own farm all the pork that he puts into the market.

Mr. BURNETT. I thought everybody knew that my business within the last few years has grown so that I do not raise all the pork that I put into the market. My customers generally know that I am buying pork all the time, and I tell them so. But I do exercise the greatest care. In the first place, I have scattered about in the three great pork sections of this part of the country three buyers. Those men are in my employ through the pork season. Their pork is engaged frequently six months before it is taken, and that pork is paid for above the market price. It comes to my place, and is there generally from two to four, sometimes six weeks; and then that pork, after going through these men's hands, after being killed and dressed and cooled for forty-eight hours, is put on the bench. I have two or three men in my employ who can tell, and I myself am such an expert that the moment my knife touches a pig I can tell, whether the animal was fed on slops or corn-fed.

There is just as much difference in the meat or pork of a pig that has been well fed and one that has been poorly fed, as there is in milk from a cow that has been well fed and one that has been kept on distillery slops. I know that an expert can tell the moment his knife touches a pig, when it is ready for the bench, whether that pig has been well fattened or not.

Mr. Bill. At what age would you stop feeding skim milk?

Mr. Burnett. If I had to feed my skim milk or throw it on the ground, I would feed some of it up to the time I killed them. I think you can feed it four months to advantage. There is a great deal of difference in feeding pigs. Some men, even with skim milk, cannot make pork so readily as other men without; but the conclusion I have come to, and it is backed up by the experience of careful breeders, is that there is nothing like skim milk for young pigs, and it can be fed with safety up to the time of killing. Some of the poorest pork that I ever put my knife into had been fed on the refuse of a cheese factory.

In England, they are feeding pigs on nothing but barley, and that pork is prescribed by physicians for consumptives. A barley-fed pig is as different from a corn-fed pig as a corn-fed pig is different from a slop-fed pig. The meat is not oleaginous; it is more like the fat on a pig's foot, — glutinous; and that pork is considered very healthy, and is prescribed for people with delicate lungs. Barley-fed pork is sold in the London market at from four to six cents more a pound than ordinary pork. That shows exactly what feed will do in producing a given result. You all know, here in this dairy region, what a difference the character of the feed makes in the milk of cows. I have made this assertion many times, that I did not care what breed of cows you gave me, unless you would give me the food to back the breed up. I would not give a rap for the cows, whether they were Channel Islands breed or any other. If you have not got good butter feed you cannot make good butter.

Mr. Bill. I am very glad I have drawn out the remarks of the gentleman. We all know that pork has been considered an objectionable article of diet for the human family, as productive of a great many skin diseases. This discussion has brought out what was new to me, and I presume may be new to many of the audience, that the meat of this animal, so objectionable when fed as it is ordinarily fed, may become a medicine.

Mr. BURNETT. The statement comes directly from an Englishman who has prepared that pork for the London market.

Secretary RUSSELL. I recommend that this question be discussed at the institutes, and the fact stated by Mr. Burnett published in the newspapers. If you can only get some of our fashionable Boston doctors to recommend barley-fed pork, your fortunes are made. It will have a great run.

I will say further, that four or five years ago I had a crop of barley, and, there being no special market for the grain at that time, I fed it to four pigs, and I never knew pigs fat better. They were killed at seven months and a half old, weighing about 225 pounds. I disposed of the pork in the neighborhood. If I had known that it was medicinal I should have got a high price for it. [Laughter.] I propose the next time I have barley-fed pork to get all the advantage out of it I can.

Mr. HARTSHORN. I wish to say one word in regard to pork as a medicine. Some three years ago I received a postal card from a gentleman in Worcester, saying that he wished to see me. I called on him and found he was sick. He said the doctor had seen him and questioned him very closely in regard to his diet, and among other things asked him if he ate pork. "Pork! no; I have not eaten pork for ten years. I don't use any lard; I won't have it in my family." The doctor said, "That is what is the matter with you. You have got to eat pork, and my advice to you is to go to some farm where you know you can get nice fresh pork, have it cooked well, and eat it." That gentleman is living to-day. I furnished him with pork for a year or two. I don't know where he gets his pork now, or whether he has given up eating it or not.

The subject of caring for hogs and keeping them clean has attracted my attention somewhat. I have kept hogs under my stable, and I have had some trouble in this way

I would find that a hog could not move his hind legs. In one case, when the hog was so lame that I thought he was worthless, I took him out of the stable, made a pen out of doors, where he would be cool and dry, put in some corn, and left him, as I supposed, to die. He wouldn't die. He lingered along for some days in about the same condition, and then began to drag himself about. He couldn't use his hind legs, but in two or three weeks he came out all right and matured well. This last summer I kept some hogs under the stable in the same way, and my men told me that one of them was so lame he couldn't walk. I went down to the stable and found that the only way he could get about was by pulling himself along with his fore feet, dragging his hind feet. I took that hog outside and put him in a clean, dry pen. The trouble seemed to come from the kidneys. He had no power over his hind legs. I gave him a cathartic and a thorough rubbing across the kidneys, and in a very few days, less than a week, that hog had perfect control of his hind legs and came out of it all right.

I think fresh air and fresh grass are very necessary sometimes to keep hogs in good condition. I found at one time that my hogs, instead of sleeping together, were scattering themselves about the pen singly and did not come to their feed well. I turned them out to grass one pleasant day in the morning. Some of them appeared to enjoy it very much indeed; others hid themselves down in a corner, and did not seem to have any desire to move. In the afternoon it began to rain and they were put under cover, with the exception of two that seemed to be all right. The hogs were put into different pens, with clean, dry straw. They came out all right. The two that were all right previous to going out, I put into the old pen, and in a couple of days I had the same trouble with them, until I put them into clean, dry quarters. I think these troubles are the result of carelessness, and that we bring them upon ourselves.

I find that it is a good plan in hot weather to give hogs fresh water to drink. I think they enjoy it as much as men do. I don't know but they take to it better than men. I have seen hogs that would go, if they did not have fresh water given them, to a pool of filthy water and drink.

Water is as cheap as anything we can give our hogs, and that, with good food and clean quarters, will give us healthy hogs.

Mr. **Wheeler**. I would like to ask Mr. Burnett if he has had any experience in feeding buttermilk to pigs, and if so, with what result? The reason I ask is, that in the butter factories there is a good deal of this product, and in some places it is not turned to any account. I know that in my immediate vicinity one has been recently started, and in conversation a few days ago with the superintendent I asked him what he was doing with the buttermilk. He said he had been selling it to the farmers along back for a cent a gallon; but they did not take it any more, and he had to open his sluice and let it go into the drain. Since I have been here some one connected with a large creamery, where they are making, I presume, two or three hundred pounds of butter a day, has made the same statement, — that they had to let that product go to waste. I remember some time within the last year reading an article in a journal that I usually consider good authority, that is, the paper with which Dr. Nichols is connected, "The Journal of Chemistry," on this point, which stated that buttermilk as food for hogs was not a perfect food, that the tendency was to constipation, but that that was remedied wholly by a small addition of linseed meal; and I think the article gave the proper proportions of linseed meal and buttermilk to make the food nearly or quite equivalent to new milk. Now, I would like to ask Mr. Burnett if he can give us any information on that point?

Mr. **Burnett**. I am glad to have that question asked me. I regret that I cannot answer it more definitely, but I will say that from experience I have found buttermilk not a complete food. Knowing the chemical analysis of buttermilk, I have always thought that it is, or should be, of the same value as skim milk, gallon for gallon. Yet it is not a complete food. Mine goes into my skim milk, and that perhaps is diluted so much that I really cannot give you any practical experience in feeding buttermilk, and nothing but buttermilk, except one test which I tried some years ago, in which case it was not successful. But there is no question in my mind that it can be utilized to very great advantage by our New England creameries.

I would like to mention one point which I think most important. Skim milk, as I have told you, is very valuable as food for young pigs; but it should be fed at about the temperature that they get it from the sow, — from 95° to 100°. It will pay you well, if you have a litter of pigs and have plenty of skim milk, to warm it before feeding. Farmers often come to me and say they cannot keep their calves from scouring. There are always two questions I ask in such a case. The first is, "Do you heat your skim milk?" If the man says "No," I say, "Try it, and see what the result will be, and do it every time." The next question is, "Do you allow your calves to be gluttons?" You can train an animal to be a glutton very easily, and all these big records made by cows are simply obtained by training, which takes from six months to a year. They are taught to eat enormously. So you can train a calf to become a glutton, and it will put its head into a pail containing six or eight quarts of milk, and the milk will disappear very rapidly. In order to avoid that, you can use Small's calf-feeder, which compels a calf to take its food gradually. Don't let your calves or small pigs become gluttons; feed in small quantities and feed often. Mr. Root says he believes in feeding five times a day; I agree with him. I said that young pigs should be fed three times a day. I have in many cases ordered my young pigs fed four times a day; I don't think I have five; but I can well understand that a good feeder will watch his pigs closely, and with their small stomachs, a given amount of food spread over five feeds would be better for them than if given in three feeds.

Mr. Porter. I have been connected with a creamery on the Connecticut River since it was first started, and the buttermilk that came from our factory when we made three or four hundred pounds of butter a day was fed to small pigs. One man bought all our buttermilk, and a year ago I shipped fifty pigs that came from his place to Mr. Burnett. They were fed on buttermilk and Indian meal.

Mr. Burnett. They came through one of my buyers, — Mr. Smith, probably. I will say this for Mr. Smith, that I very seldom have any difficulty with the pork that he purchases. I should think that Indian meal and buttermilk would make just about as good pork as anything you can feed.

Mr. PORTER. You must use judgment. You cannot begin with a large amount of Indian meal; you must work into it gradually.

Mr. BIGELOW. Do you warm your milk at the fire or with hot water?

Mr. BURNETT. I should warm it by fire. I would not add water to it. Of course, you gentlemen do not know the fact, but my farm is really a creamery and pork-packing establishment on a very small scale; and 365 days in the year I have steam up, very seldom less than sixty pounds. I have two or three steam jets which are handy for the men who look after my calves. In my piggery I have a small portable steamer, which works under a pressure of three or four pounds, and I cook all my feed for the pigs with direct steam. I have found that the most economical, the simplest and the quickest way to heat my milk and cook my food. If I had Holstein milk I should not want to dilute it with hot water; Jersey milk I should. [Laughter.]

Mr. PORTER. We don't have Holstein, we have Jersey milk.

Mr. WILLIAMS. The experience of Mr. Burnett has been much longer and wider than mine. Although I am older in years, yet he is older in this pork business, and for me to attempt to add anything to this very interesting and instructive paper would be very much like a man in ordinary financial circumstances endorsing the paper of a Vanderbilt or a Rothschild. Nevertheless, I do fully endorse every point which Mr. Burnett made; but as I look at the clock and remember that the hogs we have been talking about have not been fed for a long time, I think I had better not stand between them and the corn which they ought to have directly on my reaching home.

Mr. WARE. Mr. Hartshorn alluded to some of his pigs being unable to use their hind legs. I have had the same experience, and I learned by observation that the disease was brought on by keeping the pigs confined in rather close pens. They were kept clean, but their pens were so situated that they did not get a sufficient amount of light and air for their health. I mention this because I think it is a matter of great importance. This difficulty is a grave one, and I am quite sure is induced in that way. Allusion has been made here to keeping pigs under barns and on horse manure. I am very sure from my experience that while it may add to the value of the manure to have it rooted over by the hogs, it is very detrimental to their growth to sleep in horse manure that is fermenting and hot. In cold weather they will bury themselves in it very nearly, and become very warm indeed, and I have found that hogs do not thrive well that sleep in horse manure.

Mr. BURGESS of Nantucket. I have cut a great deal of pork in my time, and I think that if two hogs were put into a refrigerator and cooled at the same temperature, and you should blindfold me, I could tell the quality of the pork by putting a knife into it. I bought fifteen pigs last spring and took them home; I sold eight of them within a short time and the other seven I summered. I have been in the habit of feeding those seven pigs with buttermilk, which has gone directly from my house to the pigs. They have had about thirty quarts of buttermilk per day, and that is all the milk they have had, but they have had a reasonable amount of grain with it. The pigs did not weigh over forty pounds apiece when I bought them, and they have dressed from 270 to 300 pounds. My opinion is that buttermilk is very good feed for hogs, with a sufficient amount of grain.

Something has been said here about keeping hogs under barns. I had an opportunity of buying at one time of S. F. Perry & Sons at New Bedford twelve hogs which were under his stable; that is the number he has been in the habit of keeping there year after year. There is no chance for air to get to them except through a small space on the south side of the stable. He keeps about one hundred and fifty horses, and those twelve hogs were kept under that stable. They weighed more than 5,400 pounds dressed. I have seen hogs that were kept in the same place a great many times since, that came very close to that weight. So it seems to me it is not just right to say that hogs cannot be kept under a stable with very little light and air. Mr. Perry has been in the habit of raising a lot of hogs under that stable yearly.

Mr. Ware. We were told the other night by Mr. Hersey that one experiment was not proof. We have had the statement here of those hogs thriving so well under a barn with very little light and air. The man who kept the Essex House in Salem for many years had a large stable in connection with the hotel; he had forty or fifty horses, and the manure was put down in the cellar where there was very little chance for the admission of light and air, — about as in the stable cellar to which the gentleman from Nantucket has referred. He put a lot of hogs in there and fed them with the swill from the hotel, and gave them an abundance. They were there several months, and when they came out they did not weigh any more than they did when they went in. So you see there are two cases under very similar conditions, in one of which the hogs throve well, and in the other they did not.

In the statement I made I alluded to my own experience where I had kept a few hogs on horse manure under a barn. I found that they did not thrive nearly as well as they did when kept where they could sleep in straw. I believe that horse manure is very detrimental to the good condition of hogs.

Mr. Burnett. I think the pig is the best judge of this thing, and one of the best men that I have ever seen to fatten pork is Peter Davis of Framingham. Many of the older gentlemen in this audience have heard of him. He has one of the best and simplest contrivances for keeping pigs that I have ever seen in this State or elsewhere. He has a cellar which in the summer is wholly open on the south side. A pen is built in every section of that cellar under the rafters and sleepers, but they are only closed up sufficiently to keep the pigs from dropping out. Those pens hold from four to six pigs apiece, and they walk up a plank to go to their nests. They keep their nests and themselves clean. I agree with Mr. Allen, who spoke here about pigs, that there is no doubt about it that if you give a pig a chance he will take a clean nest rather than a dirty one. In that way Peter

Davis raises some of the best pork that comes into Boston. I am always glad to get it.

Mr. MYRICK. Do you consider buttermilk worth half a cent a quart for pigs? At the creameries they consider from seven-eighths to a cent and an eighth a very good price per gallon.

Mr. BURNETT. I am not prepared to answer questions about buttermilk. As I have just said, my buttermilk goes into my skim milk. I really do not know its value. When you come to feeding pigs towards maturity, I could not afford to pay half a cent a quart. You might afford to pay that price. I should be willing to pay a cent a quart for skim milk.

Mr. CHEEVER. There is a great deal of water in buttermilk.

Mr. BURNETT. I am aware of that.

Mr. BARTHOLOMEW of Blandford. Perhaps I have not had as much experience in raising pigs as others here, but such as it is, I desire to give it to you, because it is different from some statements made by gentlemen here.

A number of years ago I built a barn with a cellar under it the entire length and width. Upon the east side of the cellar is a receptacle for manure; through the centre are stables for cattle; upon the west side are pens for my pigs and hogs; upon the north side an alley-way was left, by which the hogs could run from their pens upon the manure. I kept them in this way for several years, thinking that the hogs, by rooting over the manure, increased its value. The manure from the cattle was thrown into this receptacle and also the manure from my horses, of which I keep from four to six. I have made a specialty, until a year ago, of butter-making, and have kept from sixteen to twenty cows. My pigs were fed upon the buttermilk and sweet milk from the creamery mixed together. This was always heated to ninety-five degrees before being fed to the young pigs. And let me say here, gentlemen, that when you attempt to heat your buttermilk or your skim milk for the feeding of either pigs or calves, never guess at it by putting your finger in. Use a thermometer, and then you will know at just what degree your milk is. In this way I have never had any trouble with the bowels of either my calves or pigs. But I found that by allowing my hogs to run upon the manure I did not get satisfactory results. As Mr. Ware has stated, in the cold weather they would bury themselves in the manure, and in the warmer weather they would get very dirty. I did not find, as some gentlemen have said, that they would return to their pens where they had nice clean beds of straw, particularly in cold weather. If it was cold they would bury themselves in this manure and lie there the whole time. Of late years I have entirely shut my hogs off from the manure and I get better results. My pigs are clean and they are more healthy.

Mr. Grinnell. I have bred thirty or forty pigs a year, kept them until they weighed from two hundred to two hundred and fifty pounds, and then sold them to Mr. Smith, Mr. Burnett's agent, and, as he says, he gets the best pigs that he buys from our section. He sends down from twenty to thirty car-loads a season.

What I want to speak about is a little foreign to what has been said. There has been very little said about the diseases of the hog. It is proper that something should be said on that subject.

Rheumatism is not an uncommon thing among hogs, and it is rheumatism, probably, that affected those hogs,—kept in wet, damp and illy ventilated places. I have had rheumatism in hogs in certainly two instances where they were kept in quite dry pens, but I have always had them cured by rubbing. But I want more particularly to say, and I say it with a good deal of positiveness, that in our part of the State we have not had a single case of hog cholera. I do not believe there has been a case of hog cholera in this Commonwealth that did not come from the Boston and Albany Railroad, directly or indirectly, with one exception, where a car on the Fitchburg Railroad broke down and caused the famous Hawkes case of damages against the State railroad, of which you have heard. All the other cases of hog cholera you will find traceable to such points as Pittsfield, Westfield, Springfield and the like, where the Boston and Albany Railroad have brought whole car-loads direct from the West. The disease by which we have lost a good many pigs in our county, and up and down the river, has been scarlet fever, — as true scarlet fever as any human being ever had. My first experience was two years ago. I had among my hogs eight or ten shoats that were four or five months old. I had a very choice breeding sow, a thoroughbred Yorkshire, which is my favorite breed. She was the handsomest animal of the hog family that I ever saw. She was then eight months old, and I was keeping her to breed from the coming spring. My shoats had a warm, dry pen, they had a run out into perhaps an eighth of an acre of grass, and they had for feed some house swill and bran, and small potatoes boiled up and mixed in a barrel with a little salt. Those little shoats died off one after the other, the weakest ones first. I did not pay particular attention to it; I thought it was inevitable, and I must endure it. Finally I sequestered the last two with this eight months' old sow in a warm, well-ventilated pen, with a dirt bottom; that is why I put them in there. The two young shoats died, one after the other. The sow was evidently not entirely well; she ate, but was a little sluggish. One night she took her feed and the next morning was dead. Her sides and breast were bright scarlet. She was as white as snow before, with very little hair, and of course this appearance was very marked. I determined to have a diagnosis of this case, and called Dr. Gardner, who, as you know, was a thoroughly educated veterinary surgeon. He opened her and found every organ in that pig in a sound and perfectly healthy condition until he came up to the throat, which was filled with inflammation. It was asphyxia, as we term it in the human being. She died of suffocation from scarlet fever.

There were other cases near me. A neighbor of mine had a lot of pigs that he kept in a good, dry condition, not under a barn. Some of his pigs died, and as he did not want to bother with the rest of them, he gave them away, four or five, to a Dutchman. These pigs were six or eight weeks old. The Dutchman took them home and took care of them; of course he handled them some, and about ten days afterwards he was taken sick. On his hand had been a little pimple which he had irritated until it bled and became raw. From that began a suffusion of red, which extended over his whole body; he had a sore throat, a slight cough, and every symptom of scarlet fever. He undoubtedly had scarlet fever, which he took by inoculation in that hand from those pigs.

(Secretary RUSSELL in the chair.)

Mr. BILL. I have been exceedingly interested in what Mr. Grinnell has said. The subject of the diseases of pigs which he has taken up is a very important matter. In my own town, about two years ago, I think, citizens lost near half a hundred pigs, — shoats and full-grown hogs. It was called hog cholera by most people, and yet from the account he has given, and from those that I saw sick, I should say it was the identical thing Mr. Grinnell has described, — scarlet fever. They turned red, the color spread upon them, until finally, after death, they turned purple; and the difficulty of breathing, the difficulty with which they partook of their food, indicated that that was the trouble.

Now I rise for the purpose of asking what remedy the doctor who made the diagnosis recommended or suggested?

Mr. GRINNELL. He had no remedy. He said he could prescribe no further remedy than a good physician would prescribe in a case of scarlet fever, and I believe in scarlet fever as little medicine as possible is administered, the main reliance being upon good care and nursing. At any rate, he could not prescribe any medicine. But I would like to draw the attention of farmers to this subject, because I do not like to have them frightened with the idea of hog cholera when it does not exist. Cholera is a specific disease. There cannot be a case of hog cholera without showing its effects upon the bowels or intestines. In the cases to which I have referred those organs were perfectly sound, perfectly natural, the trouble being in the inflammatory condition of the throat.

Mr. BURNETT. The diagnosis of hog cholera has changed a good deal within the last few years. It has been pretty firmly established that hog cholera is due to the presence of bacteria in the blood, and that it is not a contagious disease except by actual contact. That is, if you have pigs in one pen that are taken down with this disease, the pigs in an adjoining pen, unless they come in direct contact with the diseased pigs or their excrement, or unless the man who has fed them steps from one pen to the other and carries the germs in his clothes, will not take the disease.

There is a good deal of hog cholera in New England. I know it, because I watch it very closely on account of my business interests. A good many diseases which used to be called cholera are not really cholera. I do not question Mr. Grinnell's statement, but from Mr. Bill's description, I should say that he had hog cholera in Paxton. If the disease breaks out among your pigs, isolate them and disinfect their pens at the earliest possible moment; or, better still, leave your sick pigs where they are, keep them clean, do all you can to disinfect them and prevent the spread of the disease, and remove your healthy pigs to another place and have them tended by another man.

Mr. Bill. Would it not be better to kill them at once?

Mr. Burnett. That is something that every man does not like to do. I should say there would be nothing better than extermination.

Question. Will the meat of diseased hogs fed to healthy hogs spread the disease?

Mr. Burnett. I should say, most decidedly, yes. These bacteria are described by microscopists as white in color and oblong in shape. I have no doubt that Major Alvord can tell you a great deal more about them than I can.

Major Alvord. Just a word in reference to the question of the relative value of skim milk and buttermilk as food for pigs. There is a large butter factory in Amherst where they make from 800 to 1,500 pounds of butter a day, and a very large quantity of buttermilk is sold. A series of experiments has been conducted at the Experiment Station under the supervision of Dr. Goessmann, in which a very careful comparison was made between the value of buttermilk and skim milk as a food. We have had there the advantage of knowing what the buttermilk was. Of course everything connected with the food of the animals was carefully analyzed right along. You will find the results of those experiments in the reports of the Massachusetts Agricultural Experiment Station. I think these were the most careful experiments ever made in this country on the comparative value of buttermilk and skim milk.

Mr. Bartholomew. In regard to the question one gentleman asked relative to the feeding of the meat of diseased hogs, I wish to say that we have within the last six months had quite a number of cases of hog cholera in several of the adjoining towns, and in every one of those cases we traced the disease directly to hogs, or the refuse of hogs, brought into the State by the Boston & Albany Railroad. A butcher in the town where I reside has recently lost some eleven hogs by hog cholera. Professor Stockbridge decided it to be hog cholera. Wishing to ascertain the facts about the case, I asked the man a few days ago how hog cholera came among his hogs. He said he did not know. I asked him, "Have you had your pork from the West?" He says, "Yes, I have been constantly using it." "Well, has the waste from your house been fed to the hogs?" "No," he says, "I think not. But," says he, "now I think of it, I will tell you that when I came in with my cart and found a piece of meat that had become naturally a little dirty and unsightly, I have thrown it down into the hog pen and those hogs have eaten it." I believe that in the State of Massachusetts there cannot be found a case of hog cholera that cannot be traced directly either to the use of the meat of Western hogs or to hogs obtained from the West.

Mr. Root. I have no desire to prolong the discussion of this question, but I desire to add a single word to what has been said by the gentleman from Greenfield and the gentleman who has just taken his seat. I am sorry that we have none of our veterinary surgeons here to-day who were here yesterday and the day before, but we have abundance of evidence that this disease is conveyed by meat. In the winter of 1885 there were many cases of diseased hogs. The attention of the Cattle Commissioners was called to the matter, and a hearing was had before a committee of the Legislature, with a view to legislation which would enable the Commissioners to more completely control such cases. In the investigation at that time there were some very peculiar and very interesting cases stated. I will state one fact which was mentioned to me by the Cattle Commissioners, which may illustrate the very peculiar way in which this disease is communicated.

The Commissioners were called to the Danvers Hospital to examine into the condition of some hogs there that were supposed to have the hog cholera. The hogs were examined, and the Commissioners said, "Yes, you have got it; here are the unmistakable signs." The head man was asked, "Where have you been buying your pork?" "I have not bought any pork." "What hogs have you had brought here?" "I have not had a hog brought here for years." "Where do you get your pork?" "We make our own pork. We never allow any animals to come in with our animals for any purpose whatever. Our hogs have had no communication whatever with anybody's else hogs for years and years." Well, there was a mystery; there was a case of hog cholera well defined. "Are you sure you have not bought any pork?" "Let me go and look on my books." He went and looked, and when he came came back he said they had bought four hundred pounds on a certain date. "Where did that pork come from?" "It came from Armour's pork packing establishment." There was nothing to lead to any conclusion but that the disease came from that pork. I give you what was given to me. There have been numerous cases just like that at South Hadley, Chicopee and various places. The Fitchburg line of railroad may be free from these things, but I have seen evidence that to my mind was satisfactory that in one of the principal towns on that line of railroad over fifty hogs died of hog cholera. There is no mistake about it. To my mind the evidence is clear.

Isolate your hogs and be careful not to use any of the waste from hogs of any kind, and you will be free from hog cholera. I think this question is worthy of the consideration of all, and our friend Mr. Cheever of the Cattle Commission can give you all the light that is necessary.

The CHAIRMAN. The time has fully arrived when we should take up the next question, — Corn Culture. I may close this discussion by saying that I know the Cattle Commissioners have warned the public generally against feeding scraps of Western pork to hogs. It is pretty well settled that it is dangerous to do so. But we are approaching the close of this meeting and must go to the next question.

CORN CULTURE.

BY MR. J. H. GODDARD OF BARRE.

The subject upon which I am to speak on this occasion is *corn*, an article of substantial and wholesome food for both man and beast, and with which we have been acquainted from our childhood's days, when with such a keen relish we ate our basin of mush and milk, or the nice "Johnny cake," crisp, golden and hot, spread with butter of similar golden hue. And it may well be questioned whether it would not be better for the health of the rising generation if they were to use more corn meal and less fine flour than is the prevailing custom at present.

I said corn is a crop with which we have long been familiar, and I appreciate the difficulty of saying anything in regard to it that shall be new or interesting in this presence.

What can be more beautiful than a field of growing corn in July and August, as it rustles in the breeze and glints in the sunshine, giving promise of the golden harvest of autumn; and it would seem very strange, perhaps, to any of us that any one should hesitate in recognizing this magnificent crop at sight, — and yet, according to Thomas Nast, such a one has been found. In one of his illustrations, a substantial and apparently well-to-do farmer is seen looking over the fence upon his fine field of corn, when a city "dude" comes along and says, "That's a fine-looking field, captain; may I ask what kind of grain that is?" "Certainly," the farmer replies, "that is corn." "Ah! corn, did you say? I never saw any corn like that. I always thought corn was a *liquid*, you know."

I hope no member of this Board is accustomed to use his corn in liquid form.

Corn is king! If not the absolute monarch of all vegetable products, it certainly may be reckoned as king of the cereals. Its origin is very ancient, and in those early times the term "corn" was used in a very comprehensive sense, and included all cereal and farinaceous grains which grow in ears and are used for food; as wheat, barley, rye and maize. In England, corn means wheat. In this country, maize.

We read in the Scripture that Pharaoh dreamed, "And behold seven ears of corn came up upon one stalk, rank and good;" and Joseph's interpretation of the king's dream shows that this prefigured the maximum yield in a season of exceptional fruitfulness. Some of us have seen as many ears of maize upon a single stalk. It was the corn which Joseph, by his wise foresight, stored up in Egypt that kept the people and their flocks and herds alive during the seven years of grievous famine that succeeded the seven years of abundant crops. It was in the grain fields and at the threshing floor of the princely Boaz that he wooed and won the beautiful and lovely Ruth, who in the fields had gleaned "ears of corn" after the reapers. The Psalmist also speaks of the valleys as being covered over with corn, and as shouting and singing for joy.

In this country, whenever corn is spoken of it is understood that maize is referred to, and this includes the various kinds, from the wild corn of America, with its kernels separately enclosed in a little husk, up to the "Chester County Mammoth," with its stalks eighteen feet high and ears sixteen to eighteen inches in length, and of proportionate thickness.

Indian corn is indigenous to America, where it has always formed a chief article of food for the Indian races, from whom its name is derived. Its cultivation was early introduced from America to Southern Europe and Asia, and to Northern Africa, where it spread with great rapidity. It is alleged that corn was known in very ancient times to the Chinese; but if so, it subsequently fell into comparative oblivion. Indian corn is properly a sub-tropical grain; a native, probably, of the table lands of Mexico or Peru, the great elevation of which gives them a distinctive character from the low lands in the same latitudes. It thrives best under a hot summer's sun, and its rapid growth and early ripening give it a peculiar value for high northern latitudes, where the summer's heat is as intense as the winter's cold. In England the summer's heat is not sufficiently intense to favor its production.

From a book published in London in 1857 I make an extract: —

"The maize is the noblest-looking of the cereal grasses. It is considered to be a native of South America, to have been cultivated in Mexico and Peru from time immemorial; to have been introduced to Europe about the beginning of the sixteenth century, and to England in 1562. It is at present cultivated in almost every part of the universe where the summer temperature equals or exceeds that common to latitude forty-five degrees, or even to forty-eight degrees. In France, in 1787, the principal country of the maize was to the south of forty-eight degrees thirty-five minutes, but it is now cultivated as far north as latitude forty-nine degrees. It flourishes on the western continent from about the fortieth degree of southern to higher than the forty-fifth degree of northern latitude. It is extensively produced in Africa and in Asia, on all the shores of the Mediterranean, in Spain, Italy and parts of France. Of the cultivated cerealia, it is that which, next to rice, supplies food to the greatest number of the human race, and it may be held to be the most valuable gift of the New World to the Old. In England it has been cultivated for upwards of a century in nursery gardens in the neighborhood of the metropolis, for the common purpose of supplying seedmen in all parts of the island with ears of corn to ornament their shop windows; it has also been grown in the kitchen gardens of some individuals who have lived in America, for the purpose of using the ears in a green state."

The chemical ingredients of Indian corn are chiefly starch and oil; it yields an abundance of phosphorus, and is a highly nutritious and healthful article of diet.

There are many varieties, — the lower types being the small pop-corn and rice corn, and perhaps the highest the "Improved King Philip." The lower types hybridize much more readily than the higher, and it is found by a comparison of the chemical ingredients of the different varieties that the effect of careful cultivation is to increase the starchy at the expense of the fatty elements.

The yield of corn varies from ten bushels per acre or less, on the worn-out land of the Gulf States, to 200 bushels, the apparent maximum yield, which in a few instances has been produced under very exceptional circumstances from small and carefully tended patches in Kentucky and Tennessee. In the Central States, or "corn belt," the average yield is twenty-five to thirty bushels per acre.

The crop of 1879, according to the last Federal census, averaged as follows: For the United States, 28 bushels per acre, — Iowa and Nebraska, 41; Massachusetts, 34; Illinois, 36; Kansas, 30; Louisiana, 13; Alabama, 12; Florida, 9 bushels (fractions being omitted).

The price has fluctuated from five or ten cents per bushel, at which it was often sold in Kentucky and Ohio early in the present century, to one dollar and more, at which it has been sold in our Eastern markets.

The height of the full-grown corn varies from three to eighteen feet, according to variety, soil and climate.

The corn crop in New England is so overshadowed by the immense products of the Western prairies, that we are accustomed to regard it as of minor importance. And, in fact, when we compare the corn crop of Massachusetts with the grass crop of the same section, the farmer seems insignificant in the comparison. But I think that every general farmer in Massachusetts should raise corn. Of course it is not to be expected — and I would not seem to encourage the idea — that the New England farmer is to grow corn for market in competition with his brother of Illinois. But I do say that, in my judgment, farmers generally in this region should raise an abundant supply of corn for their own use. Forty years ago farmers in Worcester County rarely bought any corn, but on the other hand they generally had corn to sell. Fifteen years ago very few farmers in this vicinity raised enough corn for their own use, and many large farmers did not grow corn enough to make a "Johnny cake;" but within a few years past there has been a marked increase in the amount of corn grown in the central portion of our Commonwealth.

During these years of fluctuation in the growing of corn in Massachusetts the production of this superb grain has been steadily and rapidly increasing in the great West. Vast tracts of virgin soil have been opened to its cultivation, and new and improved methods and machinery have been brought to bear upon the work, until the product of corn upon those vast and fertile prairies has become immense, — almost beyond computation.

I should like to give a very few figures from the census report already referred to, but not more than, I hope, you will be able to remember.

The corn crop of our own State in 1879 was, in round numbers, seventeen hundred thousand bushels (to be exact, 1,797,768), while the crop of the United States was seventeen hundred million bushels (exactly 1,754,591,676). Recollect, Massachusetts seventeen hundred *thousand* bushels; the United States seventeen hundred *million* bushels!

But the human mind fails to grasp adequately that immense quantity of corn. Let us load it on cars, 500 bushels to the car, and we find that more than three and a half million cars will be required for its transportation, making a train long enough to extend quite around the earth, without allowing any room for locomotives. Think of that, and then doubt, if you can, that our country can furnish the world with corn.

Is any one ready to say it does not pay to raise corn? Then I will ask what crop can the farmer raise that will pay any better? Of course I am speaking of general farming, not market gardening. When corn is worth, say, sixty cents per bushel, and even when it is as low as fifty cents, I think it can be raised at as good a profit, provided your land is suitable, as almost any other crop. I do not feel satisfied with less than seventy bushels of shelled corn per acre, which gives a return of from $35 to $42 per acre. And it should not be forgotten or overlooked in the calculation of the profits, that the stover will pay the cost of cultivation.

Then there is another thing to be considered: there is no better way of working a piece of land that is to be enriched and prepared for grass bearing. The liberal fertilizing and the clean culture which are so essential in securing a good crop of corn will leave the land in the best possible condition to be seeded down to grass, — which is the ultimate object of the average farmer in this section, — for it must be conceded that to bring our lands into condition to produce large crops of grass is the most desirable thing to accomplish; at any rate, that is the belief of the farmers generally in this and other localities where the production of milk has become a specialty.

Corn is undoubtedly the most prolific of all the grains. The best ears of eight-rowed corn average more than 500 kernels, and it is said that the large varieties frequently reach 1,000 grains to the ear. Some varieties common in this vicinity frequently produce three or four well-developed ears from a single grain of seed, so that a yield of ten hundred fold is by no means uncommon.

I have said that every farmer should raise corn, and I will now add that every one should strive to reach a high standard in the excellence of his crop. Do not aim to grow a certain number of acres of corn, but look well to the bushels. If you have not a suitable quantity of manure for *two* acres, plant *one*. Let the ground be well plowed and the manure thoroughly worked in, and the soil rendered as fine as possible. It is a good rule to harrow it as much as you think sufficient, and then harrow it again. Have this work all done, if you can, before the 15th of May; but do not be in a hurry to plant until the ground is warm enough to ensure the immediate germination of the seed. The sooner it comes up, the more rapid and healthy will generally be its growth afterwards.

Farmers generally should give more attention to securing the best varieties, and especially to saving their seed-corn, for by this latter means the quality and yield of the crop may be materially improved.

I said it is well to seek for the best varieties. But we sometimes do not feel satisfied with what we have, although it may be the best thing for us, and in looking for something better we make a mistake.

I am satisfied that it is not safe to change the seed of corn from one locality to another, as we do with great advantage in the case of potatoes. A variety of corn that has become acclimated, so to speak, in a certain locality will continue to improve year by year in the same locality; but if taken to another place, even though but a comparatively short distance, will be very likely to disappoint you by not ripening as early, by some weeks, as it had done in the locality from which it was brought. That is exactly what happened to me the present season.

For several years I have raised a variety of improved "Canada Cap" corn, which has always been ready to harvest in September. The ears are small, but numerous and closely packed, and the yield has been equal to seventy or seventy-five bushels of shelled corn to the acre. Last fall, at one of the fairs which I attended, I saw some seed-corn that attracted my attention, and upon inquiry it appeared to be an improvement upon what I had, so I procured and planted it. It came up and grew beautifully, and my field was often spoken of as a fine piece of corn; but at the time of harvest I was disgusted with the result. The ears and kernels were large, and the number of basketfuls quite satisfactory; but the corn was not matured, even as late as the first of November. And where I had, with the small kind of corn, not more than one basket of pig corn in a hundred, this year the pig has more than he can eat. I had better have "let well enough alone."

In preparing ground for corn, I prefer to have rows both ways, because the after cultivation can be better and more easily done than when the rows are only one way. I use a marker adjusted to make five rows to the rod, which gives 4,000 hills per acre. Four or five stalks to each hill, according to the variety, are enough.

In my own operations upon a small farm I do not use the corn-planter nor the Thomas harrow, both of which implements may be advantageous where large areas are to be planted and cultivated. Neither have I anything to say in regard to growing corn for ensilage, as I have no knowledge of my own in regard to those matters.

The preparation of the ground for corn, as we have seen, is of primary importance, both as regards the mechanical manipulation of the soil, and supplying it with an abundance of the most suitable fertilizing elements. Indeed, without proper attention to these matters we have no right to expect a satisfactory result.

But all important as these matters are, they are not more so than the after cultivation. No farmer can afford to put manure upon his fields to be absorbed by a growth of weeds, and thus allow his corn to be robbed of the nutriment intended for it, and to be overshadowed and choked out by the noxious growth.

As soon as the corn is well up so you can see the rows plainly across the field, put the horse before the cultivator and drive in; go through both ways, and repeat the operation as often as needful to keep the ground light and the weeds down, until the corn is large enough to shade the entire ground, and after that the weeds will not be likely to give much trouble. In cultivating a field of corn I make but little use of the hoe except at the first cultivating. My object is not to hoe the soil up around the corn, but to entirely clean it from weeds and leave the whole surface as level as possible. The roots of corn reach out long distances during the season of growth, and they keep comparatively near the surface, so that deep plowing or hoeing is liable to destroy them and sensibly injure the crop.

This flat cultivation is not the method of our fathers, exactly. When I was a boy, and rode the old mare to plow out the corn, there was no such implement on the farm as a cultivator. The plow was allowed to run to a good depth, generally turning the furrows towards the rows. Then the men with their hoes hauled the soil up around the corn to cover the weeds and make a "hill" There are some farmers who still adhere to this custom, perhaps not *wholly* because their fathers did so, but they think this way the best, not having tried any other method.

There is a difference of opinion among intelligent farmers in regard to the best method of harvesting corn. There is probably some saving in labor in the harvesting by cutting the crop at the ground instead of topping the stalks, and it is claimed that the fodder is better. But I do not think the process of husking is so pleasant when the corn is cut up near the roots and shocked, as when the stalks have been topped and the corn harvested in the good old way of our fathers. Neither do I think the grain is as good and as heavy as when ripened in the old-fashioned way. I am aware that this is disputed ground, and I shall not be surprised if somebody claims that the grain is even heavier and better if cut before the kernel has become hardened than when allowed to ripen upon the growing stalk. In fact, I have heard that statement made already, but have never heard any reason given which seemed at all satisfactory. Of course, if the crop is late in ripening, and there is much danger from frost, it will be the better course to cut and shock, for by that means you save the grain and the fodder at the same time.

But every intelligent farmer will, after experience, be able to judge what method is best for him to follow; but I would take that course which seems to give the best results, both in the grain and in the stover, even if more labor is required. From the same book already quoted I take another paragraph: —

"The time for topping is when you, upon stripping the husks, open a little at the tops of the ears, find the grains to be hard, — not hard enough to grind, but hard enough to resist the strong pressure of the thumb nail. A second criterion is, all the farina having quitted the tassel and the tassel having become dead and dry. A third is, the perfect deadness of the silk; where, instead of the bright green that appeared before, hanging gracefully down, you will perceive it to be a little contemptible bunch of withered-up and brown-looking stuff. When all these signs appear, the top and the blades have performed their office, and the sooner they are taken away the better; because after this they do no good, and only serve to retard the ripening of the ears by the exclusion which they cause to the sun and wind. These tops are now a precious deposit for the winter, and weight for weight will give more nutriment to cattle than hay."

This estimate of the value of well-cured corn-tops, though somewhat ancient, has been substantially corroborated by the statements of members of this Board, and by experiments by a no less careful man than Hon. George S. Boutwell, who published the results in the "Ploughman" some years ago.

A suitable and convenient place for storing and drying the corn after it has been husked is indispensable on every well-regulated farm. If it is spread upon a floor it must of necessity occupy a good deal of room, or there will be danger of moulding. Sometimes the season is too short or unfavorable — like the one just past — to admit of the crop being fully matured and ripened in the field, and in such a case the danger is much greater.

I think a building of suitable size — say six feet wide at the base and a foot wider at the top, and six and one-half or seven feet high, and of suitable length — is the best arrangement for the purpose. It should be enclosed with perpendicular strips about three or four inches wide, with spaces three-eighths of an inch between them, to admit of a free circulation of air. There should also be cracks in the floor. Set the building upon posts two feet from the ground, and have a door at one end. Each section of four feet in such a corn-house will contain at least one hundred bushels of ears; so one can easily calculate how long to make his corn-house in order that its capacity may be sufficient for his needs. With such a corn-house properly constructed you can store your crop in very compact shape, and still feel no apprehension in regard to its curing, if it is reasonably well ripened. You may also have your corn secure from the depredation of rats, if you use proper care in the construction of your building, which is a matter well worthy of attention.

Corn is a grain so universally used as food for almost every kind of domestic animals, that it is hardly worth the while to say anything in regard to its uses. There is one minor point, however, about which people differ somewhat, and I suppose they always will: Does it pay to grind the cobs? If the meal is to be fed to milch cows I should prefer to have the cobs ground with the corn; but the grinding should be finely done. I am not prepared to say just how much intrinsic value there is in the cob; but when we consider the saving of labor in shelling the corn, I think we can afford to pay for the grinding of the cobs with the corn, and I think such is the practice of a majority of our farmers.

My remarks in regard to corn, thus far, have related entirely to *field* corn, as distinct from *sweet* corn. But I am unwilling to close this paper without a suitable recognition of the merits and importance of that branch of the corn family.

No dinner table in New England, at least, can well afford to be habitually without a supply of this succulent article of food in its season, — sweet corn. It is so easily grown and so universally relished, and withal so wholesome and nutritious an article of food, that it is surprising that so many good farmers, and in many respects good providers, neglect to provide for an adequate supply of this substantial luxury for both early and late use. There is no good reason why sweet corn, tender and fresh, should not be upon every farmer's table from July or early in August until the frosts of autumn destroy it.

How often do we hear some farmer say, in the season when the luxuries of the early kitchen garden should load his table, I *meant* to have planted some early peas and beans and sweet corn, but I was *so* busy I couldn't find time; and when we hear this we always *think* that is not true. You can take time for these things, and you can *afford* to, besides. Even if the important operations of the farm have to be delayed *one day*, in order to have the garden attended to at the right time, there need be no consequent loss. And then think of the satisfaction you will have given your wife, to say nothing of the direct results to your own palate.

But it is not alone for the table that sweet corn should be raised. Every owner of a cow and a bit of land should plant a suitable quantity of sweet corn to supply green feed from the first of August until frost comes, at least. The " evergreen " variety I regard as the best for this purpose. The ground should be liberally manured, deeply plowed and thoroughly harrowed. Make the rows three and a half feet apart, and plant in hills twelve or fifteen inches apart, with eight or ten grains in each hill. If planted in this way in a favorable season, the ears will develop abundantly in the latter part of the season, affording an abundant supply for the table and the cows, besides plenty of seed for next year's planting. The first planting should be at about the time of planting other corn, so that by the first of August, when usually the feed in the pastures begins to fail, the corn will be of good size, with tassels well developed, and ready to begin upon.

If the ground is rich, as it should be, there will be a rank growth; but it is so sweet and tender that even the largest stalks will be eaten up clean, and the results will appear in the improved condition and increased products of the animals.

It is the practice of very many farmers to grow Southern corn for green feed in preference to sweet corn, because they say it grows faster, and they plant at several different times for a succession of crops, intending to use it before the tassels appear. But I think they make a mistake. For it has been demonstrated by experiments that green corn is of little value as feed for cows before the tassels appear, in comparison to its more mature growth, and that its greatest nutritive value is only attained when the ears are well grown, at which stage it is of double the value, pound for pound, to what it is before tasselling. From experience and observation I am fully satisfied that it does not pay to feed half-grown corn; in fact, I regard it as a positive waste. Hence I would advise to plant sweet corn, and plant it early, so that it may be well grown by the first of August, from which time it will continue to increase in feeding value until frost comes.

Gentlemen, I have thus given you, in response to the courteous invitation of the Honorable Secretary of this Board, my views in regard to the cultivation of corn, together with some results of experience and some hints as to what I regard the mistakes of others, not so much with the expectation of instructing any one, as with the hope of awakening an interest among the farmers of Massachusetts in a matter which I think is to have an important bearing upon their success, whether engaged especially in the rearing of stock, the fattening of beef or the production of milk.

The CHAIRMAN. Gentlemen, there is no more important subject than the one which has just been so well treated by Mr. Goddard, and it is a subject which heretofore, when presented to the Board, has always been very thoroughly discussed. I hope in the time which we have you will proceed to that discussion with your essayist.

Mr. WARE. I would like to ask Mr. Goddard one question. I am not certain that I understand fully his position. He says that the stover will pay for the cost of cultivation. What I want to know is, whether he intends to include the cost of fertilizers also, or simply the cost of cultivation?

Mr. GODDARD. I don't think I should hesitate to include that.

Mr. WARE. That being a fact, what does a bushel of corn cost the farmer?

Mr. GODDARD. I have not figured it exactly, but I have in my experience become satisfied that I cannot afford not to raise it.

Mr. WARE. Is it not evident that if the stover pays for the cost of cultivation and fertilization, we get the corn for nothing? That is it, isn't it?

Mr. GODDARD. I know very well from what I have heard the gentleman say that he thinks he is able to demonstrate that it will cost nothing.

Mr. WARE. I want to know whether that is not your position?

Mr. GODDARD. That is my opinion, but I have not gone into figures, as I think you have.

Mr. WARE. I only want to say that I am rejoiced that so able a man as the gentleman who has presented this essay has so fully demonstrated the position I took last year, which was so vigorously attacked. It is evident to my mind that the world moves, and that we as agriculturists are moving in the line of progress.

Mr. BURGESS. I would like to say a few words relative to the corn crop. All I can tell you is the experience I have had on my own place. I had an opportunity of entering for premiums two pieces of corn this year. The land for one of the pieces was plowed last fall, and about fifty loads of barnyard manure to the acre put on. I call a load what we draw out of our barnyard at this time of the year, say twenty-five bushels. I plowed this piece late in the fall for the reason that the land was clayey, very hard, and the last time it was plowed, which was in the spring, it was rather stubborn, and so I adopted this method. Right alongside of it I left the green sward, and put the same amount of manure on the sward early in the spring. That, I plowed under. I treated both pieces just alike. The corn was planted in hills three feet and a half apart, and the result was, that on the piece where the manure was plowed under I got seventy-five bushels of shelled corn to the acre; on the piece where I put on the manure and cultivated it in I had seventy-two bushels to the acre. I shocked that fodder and weighed it on the 21st day of November. I had on the piece of ground where the manure was plowed in 7,680 pounds of fodder; on the piece of ground where the manure was cultivated in I had 6,700 and some odd pounds. I figured the corn at just what I could buy it for delivered on the wharf at our place, and I figured the fodder at eight dollars a ton. I presume that after that time the fodder would have shrunk more or less, because where we are producing that amount of corn there is a good deal of moisture in the stalk, which it takes a long while to get out. The result was, after charging all the expense of plowing and cultivation, and charging the crop with twenty-five loads of manure, at one dollar a load, the balance of the manure being charged back to the land, I had sixteen dollars and some odd cents profit on one acre, and ten dollars and some odd cents on the other. That was the result of my experience in corn culture this year.

The CHAIRMAN. Perhaps Mr. Brimblecomb of Barre can tell us something about his success with corn this year.

Mr. BRIMBLECOMB. My experience in the management of corn is not very extensive, so far as this present season is concerned. I had a small piece of ground last year in potatoes, just half an acre, I suppose; I had a piece of green sward adjoining which I wished to break up for the purpose of working out some foul matter that had got into it. That was, perhaps, about an acre; making an acre and a half in the whole. That green sward I broke up and put upon it about thirty loads of stable manure, got some seed from Mr. Goddard of his small corn, and planted it about the 25th of May on the green sward. I spread the manure after it was broken up, cultivated it in with a wheel harrow very thoroughly; and the corn, I thought, was not coming up. Finally it began to come out of the ground, but very late. It was several weeks before it fairly got started. My men who worked for me thought I had better turn it all in and sow some barley. I went up and looked at it, and concluded to let it grow and come to what it would. There were a great many hills that did not come at all; some had one stalk, some two or three, some five, and some six. I let them all stand and make what they would. I did not adopt flat cultivation; the corn was hilled, and it was hoed twice, and cultivated both ways with a cultivator. That is the length and breadth of the cultivation. It was cut up from the bottom, and we have just husked it out. It was shocked up and stood in the field until towards the latter part of November. From the acre and a half we had two hundred and ten baskets of sound corn, and some twelve baskets of soft and poor corn. That makes, as we usually estimate, seventy bushels of sound shelled corn to the acre. Many of the stalks bore three ears, a great many two, of good, well cured, sound corn, and there was a great stand of stover. I don't know how much I should have had if it had all come up well. I ought to say that I used a very small amount of Stockbridge fertilizer in the hill.

Mr. Wheeler of Great Barrington. I was a little surprised at the answer Mr. Goddard gave to the question asked him by Mr. Ware, I think, in regard to the maturity of this corn, — whether it was ripening earlier under his cultivation. Having been brought originally from Canada, further north, I was surprised to hear him say that it ripened earlier now than when he commenced with it. Am I right?

Mr. Goddard. I would like to say that I procured this seed from a farmer in this town, who said he had grown it for thirty years.

Mr. Wheeler. That was so at variance with the nature of the plant and with my own observation that I wanted to get some explanation of it, if it was really a fact. But with the explanation I consider it thoroughly acclimated corn when he took hold of it.

Mr. Grinnell. Before any more members of the Board go I desire to offer a resolution: —

"That the members of the Board of Agriculture desire at this time to express their satisfaction at the success of this meeting, and their thanks to those citizens of the town who have contributed to that success by their presence, and by their hospitality to the comfort and convenience of the Board."

The resolution was adopted unanimously.

Mr. T. P. Root. I desire to say, sir, while it has been the custom, perhaps, to pass this complimentary vote thanking the people of the community for their hospitality, and while fourteen years ago it was my privilege to welcome the Board here as its local member, and while we have felt a great desire from that time to this that we should enjoy the same privilege of meeting the Board in its official capacity, until this week we have failed of the realization of our hopes, and I desire, in behalf of the people of Barre and its vicinity, to tender to you our sincere and warmest thanks for your kindly presence, for the able papers which you have presented to us touching the most important features of agriculture, starting with the position of Holstein cattle in America, and going through the programme, taking up the most important and vital questions which relate to the success of agriculture. We want to thank these gentlemen for their painstaking care, for their careful and scientifically prepared papers. We have listened attentively to them. We have been charmed with the spirit and style of their productions, as well as instructed and inspired to new and more vigorous action on our part to rise to a higher standard in our chosen profession. We want to thank you as a Board, collectively, for the investigations which you have made, with unpaid labor, and presented from year to year at your various meetings, for the benefit of Massachusetts farmers and of the world at large. We want to tell you that we have appreciated those labors, that the farmers of Massachusetts generally have appreciated those labors, that the country at large has appreciated those labors, and that now in many a quiet farmer's home the Massachusetts Agricultural Reports are sought for, carefully laid in the library, to be attentively perused in the evening, or whenever leisure shall enable the farmers and their families to do so, and the treasures there found carefully stored up for future use.

I want to thank the public press for disseminating the proceedings of this Board through the daily papers and the agricultural papers of the State, and thus spreading abroad the facts which you have given us. The only trouble has been, that some of us who live at some distance from this village have been denied the privilege of welcoming you to our homes, sitting with you at our quiet tables and enjoying your interesting and instructive conversation.

Mr. Chairman (Secretary Russell), I want to thank you for your inspiring presence here. I want to thank you for the years of labor which you have given for the promotion of the interests of the farmers of Massachusetts, for your most happy and felicitous way of carrying forward the work which you have had in hand. You have said that you do not expect to go higher, that you have taken an honest pride in your chosen work; yet we know you will go higher, because, when a man is honest and disinterested, place him where you will, he will remain faithful to his trusts. You are a farmer yourself, and have been reared with farmers,—honest men, proud of their calling. We know that you will do the work in the higher position to which you have been called with independence of thought and clearness of action, and we have no fear that you will not give us all the "protection" that we need. [Applause.]

Adjourned to 1.30 P. M.

AFTERNOON SESSION.

The closing session of the Board began at 1.30, and the meeting was called to order by Mr. GODDARD.

The CHAIRMAN. I have great pleasure in saying that we are to hear from Major Alvord of the Agricultural College.

Major H. E. ALVORD. Mr. Chairman, there are points which I wish first to mention. To begin with, I supposed that the interest in dairy matters here in Barre and its neighborhood was so largely confined to the production of milk for sale or for manufacturing whole into cheese, that butter making would not be a subject to attract much attention locally. In the second place, my grist about associated creameries has been ground over so often in Western Massachusetts before audiences in this part of the State, in the public press and in the Massachusetts reports, that it cannot be made much finer by running through the mill again, and it will hardly improve the quality. In the third place, I came here yesterday to attend your meeting without any expectation of taking any prominent part in the proceedings, and therefore I am not properly prepared to present this subject to you as I would like to do. I do not like to rely altogether on my memory for facts and figures on any such subject; but it is one of very great interest to me, has been for years, and I claim to be so far familiar with the general subject as to be ready to do what I can towards giving facts in connection with it, especially in the way of answering questions. This morning I received a request to say something on this subject, understanding that it was desired by some of those present that I should do so; but I was not given, perhaps, as full an idea of what was wanted as I should like, and I think probably the better way would be simply to open the subject, and then to allow those interested in the matter to ask questions of me, and others who are, no doubt, more competent in many respects to answer them.

I must go over somewhat old ground and give some of the reasons for my belief in the economy, profit and desirability of butter making as a specialty in farming. In this region, as a rule, we have lands which need to be improved in fertility, which we cannot afford to draw upon and reduce their fertility any more. In order to do this we must have manure in some form. While a firm believer in commercial manures to supplement the home supply, and in their economy under certain circumstances, I believe that they should not be used, as a rule, until every effort has been made to produce the greatest possible quantity of manure upon the farm, especially through a full stock of domestic animals; and when we come to look over the various classes of domestic animals, while those which have been presented to us yesterday and to-day — sheep and swine — have a good many desirable qualities, yet I think we must generally admit that the milch cow, when well handled, is the best domestic animal in the way of profit, both as a producer of milk and a maker of manure. Of course the better a cow is handled the better the profit from both these sources, — the milk produced and the manure made. We find a home market without any difficulty for the manure that we can make ourselves, but the question what to do with our milk is a good deal more serious. Under certain circumstances I believe fully that milk can be made to sell at a profit, and that it is economical to sell milk from a farm; but I do not believe it is profitable unless the conditions are so favorable that the milk commands a price which will justify the farmer in liberal purchases of food, if not of manure to be brought back to the farm to replace the fertility which is constantly removed in the form of milk. The old saying will bear repetition, that when you are disposing of milk, year after year, when the milk is taken off from the farm, whether you are shipping it for sale or whether it goes to a cheese factory, you are really selling your farm by the gallon or by the pound; and these drafts upon the fertility of the soil must be returned in one form or another. Consequently, you are not justified in selling milk or in removing it from the farm unless the income from it is sufficient, and unless you recognize it as sufficient, and are willing to replace the manurial elements removed with the milk in the form of food or fertilizers. But we may sell the cream of the milk from the farm indefinitely without any appreciable effect upon the fertility of the farm. If butter alone is removed, or the cream that makes butter, and the skim milk is kept at home, or brought back again and used on the farm, there is no appreciable draft on the fertility of the farm. This is my foundation argument in favor of the disposition of the cows' milk product solely in the form of butter, and of using the milk, as a rule, upon the farm. No matter what your class of live stock may be, skim milk and buttermilk are as economical as any food that is at the command of the farmer for the rearing of young stock, properly supplemented by other food or mixed with other food.

I am in favor of butter making, on the ground of economy, on the farms in this region. And then comes the question. How shall that butter be made? If the work is done on the old system of private management, two or three things are absolutely necessary. The butter maker, in order to get anything like the value of his product, must have a special market; he must have either one or more reliable customers to take his product through the year, or he will have to submit to the chances of the general market, which are very unsatisfactory. If a man undertakes to dispose of his butter product, as it has been done for years, by delivering a few pounds here and there to the consumer, the cost per pound of this method of disposition of the product is a great deal more than is generally recognized. It is rarely known how much it costs to put a pound of butter into the hands of a consumer who lives one, two or five miles distant, every week or every fortnight. Hence, I do not believe there is any profit in that way of realizing, with butter at ordinary prices; and if a man simply ships his butter from his farm to a large market, taking his chances, it is perhaps even less satisfactory. If we go into the markets, and examine back for eight or ten years, we find a very general preference for what is known as "creamery butter" among large sellers in the trade, and among large buyers and consumers. What is meant in the market by "creamery butter," is not butter made in any particular way, with any special appliances, but it means butter made at a factory from the milk or cream which comes from two or more farms. Mixed milk or mixed cream from a number of farms is the only thing that makes what is recognized in the market as creamery butter, as distinguished from dairy butter, which means the product of a single herd on a single farm, sent directly from that farm to the market.

Creamery butter for ten years has ranged from one to seven cents a pound more in its wholesale selling price than dairy butter, at different seasons of the year. There has been no one year for ten years that the average price of dairy butter at its best has come within a cent of the average price of creamery butter, and for the greater part of every year the difference has been nearer seven cents than one. The average difference for ten years upon the weekly quotations (I state this from memory, but from a table that I compiled myself from the most careful market reports which I could find and which I consider reliable, and it has borne the test of a good many careful criticisms),—the difference for the last ten years, by weekly averages during the year, between creamery butter and dairy butter, both in Boston and in New York, has been in the neighborhood of four cents. The experience of creameries in this State, in New England and further west, has been that butter can be made, on the average, for less than four cents per pound. It is true that a weak creamery, which has certain expenses that are just as much as those of a larger and stronger one, may run its expenses up so that it will cost five, five and a half or six cents a pound to make its butter; but, as a rule, a creamery well managed and strong enough to be prosperous can be so conducted that, if we take, for instance, the cream-gathering system, the cream can be taken from the farmer's dairy without any expense to him after his milk has been set for creaming, carried to the factory, the butter made, salted, packed, taken to market and sold for four cents or less per pound. Therefore, it is a safe statement to make, that by the creamery system the butter from a hundred cows, scattered, if you please, upon ten or twenty farms in this neighborhood, may be made and put into market and as much money returned to the owners of those cows in the course of the year, without any labor to those owners after the milk has been set for the cream to separate, as if the owners, in the present or old-fashioned system of dairy butter-making, did all the work and took all the trouble, pains and expense of making their own butter. This has been the actual experience in many places where the creamery system has been adopted, and especially the cream-gathering system, which point I suppose I need not stop to explain or enlarge upon.

Now this seems to justify the substitution of one system for the other. If we can get as much money from our product by adopting a new system as by following the old, and rid ourselves, our homes and families of all the labor of making butter, it certainly does seem worth while to do it. Of course I am speaking of the average result.

When I talk in this way, the probability is I am talking to persons who believe in creameries, or to men who have enterprise enough to make a special market and get a good price for their product. The persons who need most to be informed on this subject do not hear me. The creamery system, in substitution for the dairy system, is not a benefit to those who are on the top of the market, but to the average butter-maker, whose butter is not of the best quality, and who labors under the greatest disadvantage in getting it to market.

Again, I believe the creamery system of the greatest advantage to such communities as have poor facilities for marketing anything. I believe it is especially favorable to those who own a few cows, rather than to those who have a large enough herd to have a complete dairy of their own, and can make it really a business on their own premises. I think, from observation and careful study of the matter theoretically and in practice in this and other States, that where butter factories of this kind have been established, and where, indeed, the system has been introduced into the community, it has been found to be a great public comfort, and that it has been of such advantage as to fully justify the change, and that those communities, as a whole, would be very loth, and the individuals who are interested in them, separately, to go back to the old system. I believe it is especially adapted to New England as a whole, and especially to the districts remote from railroads; and that of the various forms of butter factories, the one which is best adapted to the present needs of this part of the country is the cream-gathering system, where only the cream is taken, where the only labor expended on the farm is that of removing the cream, so much less bulky than whole milk, and where the factory itself has but the cream to handle, without the labor and expense of disposing of a vast amount of skim milk, which is almost a waste product on their hands, and have therefore remaining only the buttermilk as a waste product, which, where I have had the management, has always been disposed of to outside parties. In many companies the rule is that the buttermilk shall sell for enough to pay for the fuel, the salt and the coloring matter of the factory. I see some gentlemen smile when I say "coloring matter." I believe the coloring matter, in certain seasons of the year, to be just as much a necessary part of butter as the salt, because people who buy the butter to eat, and who are the final judges, and for whose taste we are catering, require that it shall have a color which it does not have naturally, which nature does not give to it at all, if it is done in a harmless way.

I do not believe that there is any need of going any further on this subject in the way of opening, but I should be very glad to answer any questions which may be asked. I think that is the better way from this time on. And let me add, that I think there are those here who have had much more practical experience than I have had who will be glad to answer questions, as glad as I shall be, and to whom I shall take the liberty of referring personally if I cannot answer any question.

Mr. GRINNELL. Can you tell what the farmers receive per quart for their milk at any creamery within your knowledge in Massachusetts? You have one at Amherst, I know they have one at Hadley, and I do not know but that there are others.

Major ALVORD. That is a very difficult question to answer, because the patrons of the different factories differ so much in the ratio of cream to milk. A cream gatherer may go to one farm where ten cows are kept, and get a certain quantity of cream, and from a neighboring farm he may get the same amount of cream from fifteen cows. He may get from one farm a certain amount of cream which makes, say, ten pounds of butter from a given amount of milk, and from the next farm he may get milk enough to furnish cream sufficient to make ten pounds of butter, and yet the milk may be much more, because of the different quality of the cows. I may, however, answer the question from my knowledge of the details of these matters. I know of some factories where the dividend per pound of butter has ranged during the year in the neighborhood of twenty-five, twenty-three and twenty-six cents, where, as near as the facts could be obtained, it required ten or eleven quarts of milk to make a pound of butter the year through. In these cases the farmers were getting two and a quarter cents a quart, not for their milk, but two and a quarter cents for the cream that every quart of milk produced, and they had their milk left sweet on their hands at home.

Mr. MYRICK. And none of the work of butter making?

Major ALVORD. None of the work of butter making. The value of that milk would depend upon the use to which they could put it. But generally I think the cream-gathering factories throughout New England for the last year have paid about two cents for the cream of a quart of milk, leaving three quarters of a cent a quart, or whatever it may be, remaining on the farmer's hands in the form of skim milk, to be used as best it may. A good many factories, not merely in New England, but the country over, take whole milk and pay for it by the quart or hundred pounds. The Amherst factory, which is making from six hundred to one thousand pounds a day, — last June I think they made something over twenty-five thousand pounds of butter, — has been paying us lately, net, between twenty-three and twenty-four cents a pound for our cream. I think my last check for the college was the September check, and my recollection is that it was twenty-three and three-quarters cents for a pound of butter. The October check will be better, because we are on the upward scale now.

Mr. Grinnell. Then our farmers had better continue to sell their milk for three cents a quart. You say they only get two and a quarter cents, and you allow three-quarters of a cent for the skim milk. That would make three cents a quart.

Major Alvord. On the face of it, the sale of milk at three cents a quart would be equally good, but you have got to offset against that the fact that the milk is depriving the farm of its fertility, which must be brought back in some form, and also the fact that the farmer is saved the perplexities and expenses which attend the business of shipping milk, which is a subject which others here present are better able to discuss than I am. But the whole matter of cans, shipments, commissions and losses comes in there to be considered. The factories are very generally in neighborhood hands; your dividends are sure. It is a good deal like your road tax. The matter is in the hands of men whom you know, and if you are not satisfied you can change the administration. You cannot always regulate these other matters.

Mr. Root. Perhaps I ought to make a statement of the plan which is generally pursued here in disposing of milk. The price of milk delivered at our station has been, for the past year, eighteen cents for an eight-and-a-half quart can, which amounts to about a cent a pound for the summer six months, and during the other six months it has been twenty-three cents for an eight-and-a-half quart can. Now, the question is, Can the farmers by any associated effort do any better? We have been in the habit here for the last fifteen or twenty years of acting in an associated way in disposing of our milk through the medium of our cheese factories, which, until the last two or three years, have taken our milk during the summer months, and the milk contractors have taken it during the winter months. Can we do any better by associated effort in creameries? In North Brookfield they have a creamery, — one which is flourishing, and good dividends are paid; I should say better than those that you have mentioned in Amherst. This is a large milk-producing section. We live by milk; by it we support our families, pay our taxes and educate our children. Perhaps there is no section of Massachusetts which produces a larger amount, with the same natural facilities for it, than we do. Had we better, instead of sending our milk to Boston at the prices named, put our milk into butter, keeping our skim milk at home? I can well believe the statements which have been made by Mr. Burnett and by Major Alvord touching the value of skim milk. For four years I had a creamery on my farm; the product of about a hundred cows was made into butter, mainly sold in the home market, at adequate prices. The sweet skim milk was fed to pigs or to calves, and the results were very satisfactory. Now the farm is run down, and I have to buy fertilizers to keep up fertility.

There is another question which is so nearly allied to this that I shall be pardoned for diverging a moment upon it. Our milk has to travel about one hundred and ten miles to get to Boston. We hope in the next three months to be able to send it to Boston over the Central road, a distance of only sixty-three miles. Up to the present time we have been in the hands of one firm. It is the only firm that runs a milk car over the Boston & Albany. We are at the mercy of this firm. Without desiring to charge them with any unfair dealings, we are, I say, in that position. Now, we have this impression, that the milk contractors of Boston are going to manage in such a way that they will continue to control the milk. It has been said — I do not know whether it is true or not, but I am inclined to think it is — that within the last few weeks a combination has been made by parties who would naturally run over the Central road, by which the parties who have run for the last ten years over the Boston & Albany are going to combine with them and run over the Central, so that in that case the farmers will be left really bound hand and foot. If these two firms combine, we are to be no better off. We hope that will not be the case.

I have outlined very briefly our general situation, and if you, sir, from your very wide experience, can give us any suggestions for our future action, we shall be indebted to you. We are all laboring men here, sir; genuine "Knights of Labor;" we all milk our own cows and work our own farms, and we feel at the present time, as we never have before, the necessity of adopting in the immediate future some positive course of action.

Mr. Ware. I think the question that Mr. Grinnell asked here is a very important and vital question. It is one that I have asked a good many times of farmers who were disposing of their cream to creameries, and of the officers of the creameries themselves; that is, how much the farmers got for their milk? I never got an answer. I felt quite desirous to obtain that information, and as usual, when I am puzzled on any agricultural question, I sent to Dr. Goessmann, the Director of the Experiment Station. They have two cows there that they have been experimenting on for the last year, and I knew that they kept exact records. He replied to my question by giving me the record of those two cows, which I will say are ordinary cows, such as would generally be bought by a farmer, without any special purity of breed. They are grade cows, bought when they were new milch. He gave me a statement of just how much money they had received during five months for the cream, how much milk they had given, and the value (as they could tell as no farmer can tell) of the skim milk for feeding purposes to pigs. They have an exact record of that, as near as can possibly be obtained, and also of the buttermilk. I have not the figures with me, and cannot give you the fractions, but I can approximate very nearly the amount. Summing up the amount that was received for the cream and the value of the skim milk fed to pigs, the value of the milk per quart, for the five months, was a small fraction over two cents. It seems to me that that is a pretty fair average of the value of the product to farmers in general.

Major Alvord. Which five months?

Mr. Ware. It commenced in February, I think, and ended in June, — about a fair average of the year. It seems to me that that would be a fair average of farm milk in general, taking the herds as we find them, and as the milk is collected and put into the creamery; so that I think it is fair to consider that all the farmers receive for their milk, taking into consideration the value of the skim milk for feeding purposes, according to the results of experiments made at the Experiment Station, is a fraction over two cents a quart.

As I say, I found great difficulty in getting the question answered. I have never been able to get an answer from any source except this. That is all I have to say.

Mr. Taft. How much did it cost to make that milk?

Mr. Ware. That did not come into the question.

Mr. Taft. I know, but I suppose Dr. Goessmann has it.

Mr. Ware. I do not know. I did not ask him.

Mr. Taft. They got a little over two cents a quart, you say. Now, my question is, How much did it cost to keep the cows during the time?

Mr. Cheever. A little less than a cent a quart, I think Mr. Ware reported at Boston.

Mr. Ware. No; I said that the value of skim milk was a little less than two cents a gallon for feeding purposes.

Mr. Childs of Warren. As I understand it, this record covers the first five months from the time the cows came in, or soon after.

Mr. Ware. Or soon after. Perhaps not immediately at the time, but they were what would be called new milch cows. I think the five months ending in June would make about a fair average of the year.

Mr. Childs. Is it not a fact that the milk for the first five months after a cow is in milk, and especially if it be in the spring of the year and during the month of June, has a much less percentage of cream than during the next five months, and therefore is it a fair estimate?

Mr. WARE. Most likely that is the fact; but you will remember the five months included a part of the winter months, and then they were nearer new milch cows than they were the latter part of the five months. Probably the milk would not be quite as rich, on an average, as it would be taking the whole year through. I presume that might be so.

Mr. CHILDS. Instead of saying "not quite as rich," I should say that the milk produced in February, compared with the milk of the same cow the first week in November, for instance, would be not over two-thirds as rich.

Mr. WARE. That is a matter of conjecture.

Mr. MYRICK. This matter of the payment per quart for milk, as we have had it explained here, is a pretty hard thing to get at. The report from the Experiment Station is probably figured quite accurately. Dr. Goessmann never makes mistakes in such matters, but I should depend more upon the results in creameries in actual operation than upon any two cows for any five months, at any place. There are creameries in operation in this State in milk-shipping towns. There is one at Lancaster, there is one at North Brookfield, there is one up in New Hampshire. At Whitins, where they used to sell milk, they have started a creamery, and the farmers in those places are uniformly better pleased with the present system than they were when they sold milk to contractors. Very few of them leave the creamery to sell whole milk. Down in Connecticut, where they have some forty-five creameries, they get from three-quarters of a cent to one cent and a quarter a quart for their skim milk at the door, taken by peddlers, and they get what they claim and what they believe is equivalent to one and three-quarters cents per quart in summer, or two cents (they mostly figure it at two cents in summer), and two and a half cents in winter for their milk. That is to say, the cream from a quart of milk gives them a return equal to about two cents in summer and two and a quarter or two and a half in winter, and on top of that they get what the skim milk is worth. It is the actual experience of these creameries in milk-shipping sections which it seems to me should determine this question to the satisfaction of practical men who are selling milk or who are making butter.

Major ALVORD. I, of course, can express only my individual opinion. There are, no doubt, gentlemen here who have had experience with factories that handle whole milk, but certainly from my own observation I have been fully convinced that the cream-gathering system is the one which gives the most satisfactory results. That is a system by which the milk is set for creaming upon various farms, the milk is skimmed, and the cream taken to the creamery by the agent.

Mr. ROOT. By the Cooley process, or some other?

Major ALVORD. I do not think that makes so much difference. If there is uniformity on the part of patrons in the way in which they handle their milk, I am not prepared to say that one set of tools is any better to do the work than another. I think that the work (although good tools are a necessity) generally depends on the workman; and with reasonably good tools a man in these days can get about all there is out of his milk, no matter what the system may be, and that there is no such difference between factories differently equipped in that respect as would make it fair for me, at least, to say that one set of appliances is any better than another. In fact, there are factories using things as different as the old-fashioned shallow pan, or its equivalent, the Ferguson Bureau Creamery, as opposed to the different forms of shallow setting, the Lincoln & Moseley, and other systems, and they all seem to be doing equally well. Others prefer open pails set in water, without any covering at all, and they get very satisfactory results. I think there are none of those in New England, but they are quite common in New Jersey and in New York.

Let me add, that I am not willing to admit that, as a rule, the butter factories in New England receive less than the value of three cents a quart for their milk, on an average, through the year. I am not prepared to support that now by an array of facts and figures, but I have the data at home, and I am so thoroughly convinced, that I will risk the assertion that they will bear out the statement that the butter factories of New England for the last two years, if you will allow a fair valuation for the skim milk, have realized very nearly, if not quite, three cents a quart for their milk through the year, as the result of this system of butter making. I have stated that to be the fact in connection with the Amherst creamery, and I have no hesitation in saying that the stock from which the Amherst factory gets its cream is not any better stock than the stock from which other factories are supplied. Ten or eleven pounds of milk to a pound of butter does not mean good butter-making cows. If I had a herd of cows that I was making butter from and could not get the average down to eight or nine quarts, I should think I was in poor business; I should think I had a milkman's herd, and that I had better ship them off. I have made a pound of butter from every seven and a half quarts of milk, and I got rid of every cow that would not give me that amount of cream.

Mr. Taft. If you increase the quality, don't you decrease the quantity?

Major Alvord. Not necessarily. You do not decrease the total number of pounds of butter from the number of cows, which is what we are after. As I understand Mr. Root, the returns here do not exceed two and a half cents a quart for the last year for whole milk; rather below than over it.

Mr. Root. Yes, sir; I should say so.

Major Alvord. I venture to say that the creameries generally through this part of the State have done a great deal better than that. I will say this, that the two cows at the Experiment Station are poor cows. I am sorry the Experiment Station has not got better stock, if that is the report they make.

Mr. Myrick. Those must be the same cows the milk from which averaged about eleven per cent. solids last year and the year before.

Major Alvord. They are not up to the Massachusetts standard in butter-making regions. I agree entirely with Mr. Myrick, that it would not do for us to rely upon the record of two cows, no matter who has them. I don't care if, instead of showing two cents a quart or less, they showed four cents a quart or more, they would be just as unreliable. We cannot depend upon any report from any two cows; we have got to cover a very large field. If Mr. Porter is here, I would like to have him tell us what their milk is worth a quart, for a rough guess.

Mr. PORTER. I have no figures with me or in memory. We have our superintendent and treasurer, who has charge of all the business. I think, however, I am not wrong in saying that we get three cents a quart the year round, although ours is a small factory. We were the first that started, and we are not in a butter-making town. We are on the Connecticut River, where the land is rich and our farmers raise tobacco mostly; but there are a few of us who have cows and wanted to go into this system. I must say that we have not made so much as we should if we had better cows. We have made three or four hundred pounds a day, but the herds of some of our farmers have been scattered, and some of them have moved out of the township, so that we are left with not so many cows as we formerly had; but we still keep the thing going.

Major ALVORD. How much does your butter cost a pound?

Mr. PORTER. It costs us six cents a pound. We hire one man to gather the cream, who takes it to the factory, churns his butter, furnishes his fuel for the engine, finds his own salt, markets the butter, pays the rent for the building and various incidental expenses, for six cents a pound.

Mr. WASHBURN. What is the lowest return per pound for the last year.

Mr. PORTER. I should say, in the hottest weather in the summer, from twenty-two to twenty-three cents. We are selling it now for thirty, thirty-two and thirty-three cents a pound.

Mr. WHEELER. The creamery with which I am connected has not been in operation long enough for me to give any statistics that would be of value on this line. I wish to call attention to one point to which Major Alvord did not allude. When you come to the question of associated dairying as compared with individual dairying, one advantage that the associated system has is the facilities which it affords farmers to judge of the value of their cows. I know that in the short time that our creamery has been in operation, some of our farmers have been very much disappointed in the quality of their cows. It is a co-operative concern; each one knows pretty well what the others are doing, and when one farmer finds that he is getting only seven or eight spaces of cream to a can of milk, and learns that his neighbor is getting twelve or fifteen, he begins to ask what is the trouble, wherein is the difference, and he is stimulated to improve his stock. There is a point that will in a few years affect a great change in the value of the dairy stock of the country.

Mr. Ware has asked a question in regard to the price which farmers are getting for their milk at the factories. It depends, of course, on the quality of the milk. I can tell what my milk has brought me per quart. That is, I can tell him how much milk it takes to make a pound of butter. It takes a little less than nine quarts, on the average, the year through. Three or four years ago, when I had facilities for keeping accurate accounts and had an equal number of cows through the year, I found that I got two hundred and fifty pounds of butter from each cow, and the butter netted me thirty-one cents a pound. It is very easily figured what the gross return from each cow was.

Mr. Root. What did I understand Mr. Wheeler to say was the net income per pound for butter from the creamery?

Mr. Wheeler. I don't know exactly. The first return, I think, was twenty cents a pound, and it has been of late, I think, about twenty-seven or twenty-eight cents.

Question. What is the expense of manufacturing per pound?

Mr. Wheeler. I would not undertake to say from memory. I have only been part of the season a patron myself, and have not had the details of the manufacture. I know that the butter at our creamery has commanded a price above the market. I know that buyers from New York have been there, and when the quotations were twenty-seven or twenty-eight cents a pound, they have offered thirty-three cents for it at the factory, which was a good deal better than the farmers who were making their own butter were getting. I presume that the expense of making butter at the Egremont Creamery is now in the neighborhood of six cents. It is a new enterprise, and not as largely patronized as it will be another season.

Mr. Fitch. The last speaker has touched a most important point in the milk question. He said that when some of his neighbors found they were getting only eight spaces of cream to a can of milk, while others were getting twelve, they were dissatisfied with the character of their cows; but that is not conclusive, because the cream of the eight spaces may have given as much butter as the cream from the twelve spaces. The only way to get at that is to have the cream paid for by the amount of butter which it will produce after it is churned. That is the only way to run a creamery properly. If you will take ten quarts of milk and set it in deep cans, and have the cream tested for the solids and the kinds of solids, and the milk tested for the solids and the kinds of solids, you will very soon find that you have two or three sets of cows: one set that gives a large amount of butter and a small amount of cheese; another set that gives a larger amount of cheese and an average small amount of butter. This latter kind of cow would be the kind that you would want to keep for your own use and that of your family. If you are going into the business of making milk for a creamery, test your cows and find out what they are worth; put into beef those that are cheese cows, and use the butter cows for your creamery, and you will find that it will make a great difference with you. If you are going to run a cheese factory, take the other set of cows.

Mr. Myrick. The figures given here a moment ago of the price of milk — eighteen cents a can in the summer and twenty cents in the winter — give an average return of two and one-third cents a quart. It is not quite as much if you allow from one to two cents a can for carrying the milk from your farm to the station. I think there are very few well-managed butter factories in New England that do not return two cents a quart. When you come to the price of milk, the figures Mr. Wheeler has given do not support the position taken by our friend over there, that there is such a great variation in the quality of cream. When it has been raised under exactly the same conditions, the variation is so slight that I do not believe the ordinary methods of churning and converting it into butter can detect it. It may be that chemical analysis might show a large difference; but with cream raised under exactly the same conditions, standing the same length of time, in the same temperature, while you will get a large variation in the quantity of the cream, you will find but a very slight variation in the quality.

Mr. Fitch. In answer to the gentlemen, I will state that what I said was from careful experiments. I kept in my office, for three months at a time, test tubes set up so that everybody could see them. You could see from across the room the butter at the top and the cheese matter at the bottom. The gentleman was never more mistaken in his life than in supposing that two lots of cream are alike. I have seen cream which, when put into the test tube, you could not detect a particle of difference between that and the cream in the next tube to it, and yet one would produce a much larger quantity of butter than the other.

Question. Was that cream raised under precisely the same conditions?

Mr. Fitch. It was taken from two herds. The best test gave over two pounds on the gauge. The cream was from a Holstein cow, one which had been shown over the country, and fed until it was a perfect machine. That cow gave nearly double what any other cow would. I have had men bring me what they said was carefully handled cream that did not produce but five-eighths of a pound. I set the test tubes up, and I never saw more angry persons than three whose tests stood there: but they had to submit to the tests.

Mr. Wheeler. I do not accept any such test. What we want to do is to set two cans of milk, filled to the same height, into one tank, at a temperature of say thirty-nine and a half or forty degrees, let them stand there a given time, and then take them out, and I say you will find so slight a variation between the milk in one can and the other, that you cannot detect it by any ordinary method of churning.

Mr. Fitch. If that is the case, then the report of the Massachusetts Board is entirely wrong. "Farmers have for a long time supposed that while milk might vary in its constituents, cream was about the same thing, but since it has been found that cream is only less variable than milk in its character," — and then it goes on.

Mr. Wheeler. I remember the quotation very well.

Mr. Fitch. You can set your two cans as you please, and you will find that the two creams are not alike. I say as you do, that the difference is not so great as it is in milk, by any means, but still it is a great deal more than you think.

Major Alvord. Both gentlemen are right, and they are both, I think, a little off. I have watched this subject of test churning with a great deal of interest. I agree perfectly with the statement that cream is only less variable, comparing bulk with bulk, than milk. So far, I agree with the gentleman on my right. Now, I claim that cream is so slightly variable, comparing bulk with bulk, that it does not pay to quarrel about it in most New England factories. Hence, I agree with the gentleman on my left. I go beyond this, and I say, that notwithstanding the excellent appliances that have been introduced at the West, — first, the test churn, where a pound of cream from every patron was churned by itself in gang-churns (a dozen or more little churns strapped on the same board), and next the Hall test churn, where they take only a fraction of cream, and, after churning it, melt the butter and measure it on a scale, — all of which was theoretically very beautiful, and perhaps, on strict principles of equity, it was desirable to have such tests, — yet, as I say, notwithstanding these appliances, I found by attending the meetings of the Illinois and Wisconsin State Dairymen's Association, and from very extensive correspondence with a large creamery association in Iowa, that a good many factories which went to the expense of buying these test churns, have finally concluded that the difference is not enough to pay for the cost; and there were a good many cases of just the same character as that to which my friend has alluded, where the patrons of a factory, obliged to yield to the decision of those tests, presented before their own eyes, were so discontented that they could not quite believe them, and it actually did more harm and created more disturbance in a factory than it did to assume that the cream was substantially alike. They have come to the conclusion that the most important element in a factory is to have a good business backbone somewhere to keep the patrons up to the mark. But I really think it is an open question yet in the West, in spite of all that has been done and said about it, whether it will really do to assert as a fact that there are any very great differences in cream.

Mr. ———. There is a slight difference, perhaps, in the quality of different cans of cream, but there is a great difference in the color of different cows' cream. That I have noticed a number of times in testing several cows' cream at once. Does the quality of the cream vary with the color?

Major Alvord. As far as I know, there is no relation, or certainly no law of relation, between color and quality. The coloring matter in a cow is just as distinct from her milk-producing organs as the quality of her hair, and a cow may have the property of coloring her milk to the highest possible point and yet be a very poor dairy cow, and *vice versa*.

The Chairman. Is there any danger of establishing so many butter factories as to overstock the market with butter?

Major Alvord. I do not believe that is a consideration which is of sufficient weight to be dwelt upon.

Mr. Myrick. Those little test tubes have been peddled through the country and sold for a dollar each. Some of the Orange County dairymen tried them thoroughly, and rejected them. When they churned they found there was no such difference as the test tube indicated. I would ask Major Alvord how much dependence can be placed upon those tubes?

Major Alvord. I think that those little glass test tubes are better than nothing for comparing the milk of cows, but I should want to go beyond that, and apply the churn test to a larger quantity. I do not think there can be any conclusion drawn from the test tube which cannot be applied to a large quantity.

Mr. BROOKS. We have in Springfield a co-operative milk association, and our system of doing business is of a different character from those which have been described. I suppose we average about three cents a quart for our milk at the farm. Our milk association has proved a splendid thing for those farmers who had nothing to do with it, never subscribed to the stock, and never sent any milk there, in this way: it has compelled the peddlers, who could not get milk where they had formerly been getting it, to pay a higher price for milk to those farmers who kept out of the association than they had been paying the same men before, and the farmers who have not joined the association have received more for their milk than their next-door neighbors who have, because the peddlers, being unable to get milk of us, were obliged to get it somewhere or give up their business. They hated the association so desperately that they would not give up the business, and it is that bitter spirit of the middle-man that is keeping us back; but we are outgrowing it, and there are milk routes offered occasionally to us, and nobody is buying milk routes to any extent outside of the association. The old peddlers hold on to their old trade, but new men are shy about coming in.

Mr. MYRICK. Are you not shy about buying any more routes, and don't you build up your trade better without buying them?

Mr. BROOKS. I said they were offered us; I did not say we were buying them.

Major ALVORD. Is it not a fact that the great load that the Springfield Milk Association is carrying is the large amount of money that they have paid for the intangible thing called "milk routes"?

Mr. BROOKS. It is, sir. We had farmers who were large milk producers who were so in sympathy with the milk peddlers, — one was a nephew and another was a cousin, — that they would not consent to come into any organization unless the organization would agree to buy out these men and pay them for their routes, which is a different thing. You might as well buy out the Piutes on the plains and pay them for their ponies, guns and blankets. There were some pretty shrewd men among these milk peddlers; they were like the lady who loved her husband, but loved another man twice as well. They would sell their milk route to the association, and then they would sell their best customers to some other peddler. We were wise enough to take some precaution. We made the peddlers sign an agreement that they would not interfere, directly or indirectly, with our business for two years. There were two or three young men who were minors, and they actually took advantage of the law, and said, "We are not holden by any contract," and they went directly out and sold milk to persons living on the route that they had sold to us.

But here is an item that is of considerable importance. We get our money for what milk goes to the association. There have been thousands of dollars absolutely lost by the farmers in selling milk to men who were not responsible; and when farmers tell how much a peddler gives for milk, if they do not look out, they do not tell it just as it is, because the majority, or at least a large percentage, of the peddlers are not responsible. They will buy milk of a farmer until they run in debt perhaps $50 the first month, and $50 the next, and the next; and the first thing he knows they have disappeared, or if not, they have no property, and the farmer has lost his money. They lose by dishonest peddlers running away and leaving large unpaid bills, so that when a farmer says he gets three and a half cents a quart from a peddler, perhaps he has one, two or three hundred dollars to take out of that, of actual loss, in one lump.

Mr. MYRICK. I understand that your association takes all the milk its patrons make and works up its surplus into butter.

Mr. BROOKS. That was a great consideration in going into this association. I had milk left on my hands when it was not worth a cent a quart. I had no way of making butter, and I did not want to be bothered with providing means for making butter.

Mr. ROOT. Your association attempts to supply Springfield with milk; do you believe that it is practicable for the dairymen of the border towns of Massachusetts to furnish Boston with milk on the same plan that you are furnishing it to Springfield?

Mr. Brooks. If I should attempt to answer that question it would be merely guess-work. I can tell you how the plan has worked with us. We have brought into Springfield too much milk; there is no question about that. The peddlers who could not buy milk of the farmers of whom they had obtained it before, went outside for their supply of milk, so there was too much milk brought into Springfield. We expected there would be at times, and we provided for working up our surplus milk; but this enmity on the part of the peddlers and their desire to keep the thing going brought in so much that we have had to work a larger percentage into butter than we expected; but as we cannot always sell our skim milk to advantage, we prefer to retail all the milk we can. We do not retail half the milk that is sold in Springfield.

Mr. ———. Your cans are returned to you clean?

Mr. Brooks. They are.

Mr. ———. That is worth something. I know more than one farmer's wife has been killed by washing eight-and-a-half quart cans. I know an instance where I believe the washing of cans was what killed the wife. As somebody has said, the old man sold his farm by the can, and threw his wife in to the bargain.

Major Alvord. Although it may seem a little indelicate to say so, I would like to put myself on record in answering Mr. Root's question. I believe that the farmers now producing the milk which supplies the city of Boston and its vicinity can, through the New England Milk Producers' Association, or some other association, supply Boston and its vicinity with milk without the intervention of any contractors or middle-men, and can divide with the consumers of the milk the missing five cents that we hear about. But I believe that it would require an organization not only of men with brains, but with a large amount of capital, prepared for a long fight, because you would have a combination, small, compact, with plenty of money at their back, to fight you to the death. You cannot afford to buy out the milk contractors of the city of Boston. In order to get your market you have simply to say to them, "Gentlemen, we have not any quarrel with you, but there is not room for both. We propose to take possession of the market, and we will see who will last the longest, — you with your money, without the milk, or we with the cows." [Applause.]

The meeting then adjourned *sine die.*

ANNUAL MEETING OF THE BOARD.

ANNUAL REPORT.

The Board met at the office of the Secretary, in Boston, on Tuesday, February 1, 1887, at 12 o'clock, it being the Tuesday preceding the first Wednesday in February. In absence of the Governor, on motion of Mr. Damon, Mr. GRINNELL was called to the chair.

Present: Messrs. Barrus, Bartholomew, Bird, Bowen, Bowditch, Brooks, Cushman, Damon, Douty, Edson, Grinnell, Goodell, Goessmann, Goddard, Hartshorn, Hersey, Hill, Lynde, Moore, Owen, Porter, Slade, A. A. Smith, Zeri Smith, William W. Smith, Taft, Upton, Varnum, Ware, Wheeler, Whiting and Wood.

Voted, To dispense with the reading of the minutes of the last meeting.

Voted, To appoint a committee of three to examine and report on the credentials of newly elected members: Messrs. Edson, Upton and Goddard.

Mr. Stockwell, successor to the Hon. Marshall P. Wilder, said: —

Mr. President, It seems proper that I, having been appointed to fill out the unexpired term upon this Board left vacant by the death of Hon. Marshall P. Wilder, should propose on the very threshold of our meeting that a committee be appointed to draft and present to us suitable resolutions to be placed on the records of the Board of Agriculture.

I first became acquainted with the venerable member in 1879, and that acquaintance and those associations, together with the friendship that followed, I hold as among the choicest memories of my legislative experience. But it is not for me to speak the words of eulogy in this presence, nor is this the time to do it.

I move that the Chair appoint a committee of three, to draft and present to this Board at its next daily session resolutions expressive of the sentiments of this Board in view of the character and services of the deceased member; and if you, Mr. President, will pardon the suggestion, I will request that my name be not used, but that those older on the Board, and therefore better able to give expression to the feelings of his associates, be selected.

Before a vote was taken, the motion was amended so that the chairman of the meeting, Mr. Grinnell, was made one of the committee. The committee was then constituted as follows: Messrs. Grinnell, Moore and Wood.

Reports of delegates being in order, Mr. Porter reported on the Berkshire; Mr. William W. Smith reported on the Blackstone Valley; Mr. Owen reported on the Deerfield; Mr. Cushman reported on the Franklin; Mr. Brooks reported on the Barnstable; Mr. Slade reported on the Hampden East; Mr. A. A. Smith reported on the Worcester North.

The Board then adjourned until 2.30 P. M.

The Board was called to order at 2.30 P. M., Mr. GRINNELL in the chair.

Mr. Zeri Smith reported on the Hampshire, Franklin and Hampden; Mr. Zeri Smith also reported on the Highland.

Mr. Ware moved that the reading of the reports of delegates be suspended and that Dr. Goessmann be allowed to submit his annual report on Commercial Fertilizers. This being approved, Dr. Goessmann read his report on Commercial Fertilizers, which was discussed and adopted.

Mr. Bowen reported on the Hingham; Mr. Douty reported on the Hoosac Valley; Mr. Damon reported on the Housatonic; Mr. Hartshorn reported on the Hillside.

The Committee on Credentials, to which was referred the credentials of newly elected members, reported the following members duly elected: —

At large, by the Governor, J. S. Grinnell and J. W. Stockwell, to fill the unexpired term of Marshall P. Wilder.

Essex Society,	Benj. P. Ware.
Highland,	W. H. Snow.
Worcester North,	Geo. Cruickshank.
Plymouth,	Elbridge Cushman.
Hillside,	S. W. Clark.
Worcester West,	J. H. Goddard.
Bristol,	Avery P. Slade.
Middlesex South,	S. B. Bird.
Deerfield Valley,	F. G. Howes.
Worcester,	C. L. Hartshorn.
Bay State,	Edw. Burnett.

It was voted that the report of the Committee on Credentials be laid upon the table.

The Board adjourned at 4.30 P. M.

SECOND DAY.

The Board met at 9.45 A. M., Mr. Grinnell in the chair.

Present: Messrs. Bartholomew, Bird, Bowditch, Brooks, Clark, Cruickshank, Cushman, Damon, Douty, Edson, Grinnell, Goodell, Goessmann, Goddard, Hartshorn, Hersey, Hill, Howes, Lynde, Moore, Owen, Porter, Slade, Zeri Smith, W. W. Smith, Sessions, Snow, Stockwell, Taft, Upton, Varnum, Ware, Wheeler and Wood.

Minutes of the previous day were read and approved.

Dr. Lynde reported on the Horticultural Society.

Voted, That the Secretary be ordered to print the report of Dr. Lynde.

Report of the Committee on Credentials was taken from the table and adopted.

Voted, To appoint a committee of three on the assignment of delegates to the annual fairs: Messrs. Taft, Cushman and Dr. Lynde.

Voted, To appoint a committee of three on the changes of time for holding fairs: Messrs. Bowditch, Wheeler and Bartholomew.

Voted, To appoint a committee of five on time and place for holding the Country Meeting: Messrs. Brooks, Damon, Hartshorn, Owen and Hill.

Mr. Taft reported on the Middlesex South; Mr. Wheeler reported on the Martha's Vineyard; Mr. Edson reported on the Middlesex North; passed over, — Middlesex and Nantucket; Mr. Goddard reported on the Plymouth.

The committee of three, on changes of time for holding fairs, reported as follows: Amesbury and Salisbury Society, fifth Tuesday after the first Monday in September; The Bristol Society, fourth Tuesday after the first Monday in September; Middlesex North Society, third Wednesday after the first Monday in September; Worcester Society (this year only), first Tuesday in September.

Voted, That the Massachusetts Horticultural Society be allowed to hold their ensuing fair, beginning on the thirteenth of September.

Mr. Moore, from the Committee on Essays, reported as follows: —

ESSAYS.

Chemistry as applied to the Corn Crop,	C. A. Goessmann.
Our Homes,	Jas. W. Stockwell.
Agricultural Education,	H. H. Goodell.
Chemistry of the Kitchen,	Dr. J. P. Lynde.

Mr. Wood read an essay on "Fruit as a Farm Product," which was discussed and adopted.

Mr. Barrus reported on the Union Society; Mr. Ware reported on the Worcester North; Mr. Upton reported on the Worcester South.

The committee on time and place for holding the Country Meeting reported by their chairman, Mr. Brooks, that the meeting should be held at Springfield. On motion of Mr. Sessions the time for holding the meeting was fixed at Tuesday, the 6th of December. The report and motion were accepted and adopted.

The Governor and Dr. Lynde were made a committee to consult the Attorney-General to get his opinion whether a member of the Board of Agriculture, and elected to the Board of Control, would vacate his position on the Board of Control at the expiration of his term as a member of the Board of Agriculture.

Mr. Varnum reported on the Essex Society; Mr. Hill reported on the Hampden Society; Mr. Barrus reported on the Worcester; Mr. Sessions reported on the Worcester West.

Mr. Hersey moved that the rule requiring all societies receiving the bounty of the State to hold three Institutes during the year be enforced. After discussion, the motion was laid on the table.

The Board then adjourned.

THIRD DAY.

The Board met at 9.45 A.M., Mr. GRINNELL in the chair.

Present: Messrs. Bartholomew, Bowditch, Brooks, Clark, Cruickshank, Cushman, Damon, Douty, Edson, Goessmann, Goddard, Goodell, Grinnell, Hartshorn, Hersey, Hill, Howes, Lynde, Moore, Porter, Snow, Sessions, Zeri Smith, Wm. W. Smith, Stockwell, Slade, Taft, Upton, Varnum, Ware and Wheeler.

Minutes of the previous day were read and approved.

Voted, That the time for the election of Secretary be fixed at 12 o'clock, M.

Mr. Hersey's motion, made the previous day and laid on the table, in relation to the holding of Institutes, was taken up, and after a very animated discussion was amended and adopted as follows: That the rule requiring societies receiving the bounty of the State to hold, at least, three Institutes during the year be restated and enforced.

On motion of Mr. Hersey it was

Voted, That a committee of three be appointed to consider the whole subject of Farmers' Institutes and report to the Board, at the Country Meeting in December, a plan for holding Institutes by the societies receiving the bounty of the State, so as to secure the best results with the least expenditure of money to the societies and the members of the State Board: Messrs. Hersey, Hartshorn and Bartholomew.

Mr. Grinnell from the Committee then submitted the resolutions of respect to the memory of Marshall P. Wilder. The resolutions were adopted, and ordered to be printed in the Annual Report and a copy to be sent to his family.

RESOLUTIONS OF THE MASSACHUSETTS BOARD OF AGRICULTURE ON THE DEATH OF HON. MARSHALL P. WILDER.

As on this thirty-fourth annual meeting of the Massachusetts State Board of Agriculture, we, its members, miss the noble presence, the benign face, the genial manner and the encouraging words of the Hon. Marshall P. Wilder, the oldest member and almost the founder of this Board; we of all other associations and individuals most appreciate his loss, and desire to record some expression of our feelings, and therefore resolve, —

That in the death of Hon. Marshall P. Wilder we have lost a personal friend, the State one of its most distinguished citizens, and the country one of the most universally acknowledged benefactors of the whole people, in our recorded history.

That during his long life in and near the metropolis of this Commonwealth, he had in every relation of society endeared himself to all with whom he came in contact; and in his daily walk and conversation was an exemplar for the young, and a guide and director for the older.

His life was beautiful, and on the scene where he had long lived and labored, "of no distemper, of no blast he died;" but his death was the gentle, painless passing away of one "who had so long walked hand in hand with time," and had illumined a long pathway with the light of a faithful Christian continuance in well-doing.

Mr. Taft made a report on the assignment of delegates as follows: —

Amesbury and Salisbury,	Wm. R. Sessions.
Barnstable,	C. L. Hartshorn.
Berkshire,	Nathan Edson.
Blackstone Valley,	D. Upton.
Bristol,	A. C. Varnum.
Deerfield Valley,	Ethan Brooks.
Essex,	E. W. Wood.
Franklin,	B. P. Ware.
Hampden,	Daniel E. Damon.
Hampden East,	S. W. Clark.
Hampshire,	W. H. Snow.
Hampshire, Franklin and Hampden,	Henry L. Whiting.
Highlands,	B. Douty.
Hingham,	S. B. Bird.
Housatonic,	E. F. Bowditch.
Hoosac Valley,	J. H. Goddard.
Hillside,	F. G. Howes.
Massachusetts Horticultural,	H. H. Goodell.
Marshfield,	Geo. Cruickshank.
Martha's Vineyard,	V. Taft.
Middlesex,	S. A. Bartholomew.
Middlesex North,	Wm. W. Smith.
Middlesex South,	Edmund Hersey.
Nantucket,	J. B. Moore.
Plymouth,	J. S. Grinnell.
Union,	Zeri Smith.
Worcester,	M. I. Wheeler.
Worcester North,	J. D. Porter.
Worcester North-west,	A. P. Slade.
Worcester South,	H. M. Owen.
Worcester West,	Elbridge Cushman.

The report was accepted and adopted.

On motion of Captain Moore it was voted that Mr. Stockwell be a delegate to the Bay State Fair.

Voted, That a committee of three be appointed to nominate members of the Executive Committee: Messrs. Goddard, Brooks and Slade.

Mr. Varnum read an essay on the "Effect of Farm Life upon Manhood."

The report from the petition of the Board of Agriculture to the Governor and Council to define the duties of the Board of Overseers of the Massachusetts Agricultural College was received, read and ordered to be printed in the Annual Report.

COMMONWEALTH OF MASSACHUSETTS.

COUNCIL CHAMBER, BOSTON, May 12, 1886.

The committee to whom was referred the petition of committee of the State Board of Agriculture, that the powers and duties of the Board of Overseers of the Massachusetts Agricultural College be defined, report and recommend the adoption of the following order: —

JOHN HASKELL BUTLER,
For the Committee.

Ordered, That in pursuance of the authority conferred by section 5 of chapter 20 of the Public Statutes, and of every other authority hereto enabling, the powers and duties of the Board of Overseers of the Massachusetts Agricultural College are hereby defined and shall be as follows: —

1. To visit the college as often as they may deem essential for the proper performance of their duties, but at least once in each year.
2. To inspect the property of the college, including the land and buildings, especially with reference to the adaptability and sufficiency thereof for accomplishing the objects of the institution.
3. To observe the methods, extent and character of the instruction which it gives.
4. To attend the commencement exercises and examinations, and, so far as they deem it expedient, participate therein.
5. To make report of their doings and observations, with their views, suggestions and recommendations, concerning the institution and its work, annually, to the legislature.
6. Power is given to perform the foregoing duties by and through a sub-committee, of not less than five members of the

Board, to be selected annually, and at such times as the Board may elect.

7. To have and perform such other powers and duties as may be, from time to time, defined by the Governor and Council.

In Council, May 12, 1886.

Adopted:

Henry J. Coolidge, *Deputy Secretary.*

Commonwealth of Massachusetts,
Secretary's Department, Boston, Jan. 13, 1887.

A true copy:

HENRY B. PEIRCE,
Secretary of the Commonwealth.

Voted, On motion of Captain Moore, that Professor Charles H. Fernald be appointed Entomologist to the State Board of Agriculture.

The committee to report names for the Executive Committee reported as follows: Messrs. Moore, Hersey, Slade, Bowditch and Hartshorn, — who were elected.

Voted, On motion of Mr. Wheeler, that the chair appoint a committee, with full authority to represent this Board before a committee of the Legislature, in reference to any action by that body in any way affecting the interest or functions of the Board: Captain Moore and Messrs. Stockwell and Goddard.

Voted, That Messrs. Bird and Goddard serve on the Examining Committee of the Agricultural College.

Voted, That a committee of five be appointed on the Country Meeting: Messrs. Brooks, Sessions, Bartholomew, Porter and Douty.

Voted, On motion of Mr. Taft, that a committee of three be appointed to sort and count the ballots for the election of Secretary, and that the first ballot be informal: Messrs. Taft, Bird and Bowditch.

Result of ballot: —

Burton W. Potter,	1
E. W. Wood,	3
Elbridge Cushman,	6

Alvan Barrus,	9
F. H. Appleton,	16
Total,	35

It was voted to make the next ballot formal.

Result of ballot: —

E. W. Wood,	2
Elbridge Cushman,	2
Alvan Barrus,	12
F. H. Appleton,	19
Total,	35

Mr. Appleton was then declared elected Secretary of the Board, his term of office to begin July 1.

Mr. W. H. Griffith was unanimously elected Secretary, to serve from March 1 to July 1.

Voted, That a committee of three be appointed by the chair to prepare a list of questions for delegates to the Country Fairs: Messrs. Stockwell, Hersey and Hartshorn.

Mr. Varnum read the report of the committee upon the Agricultural College, which was discussed and accepted as the committee's report to the Board and also to the Legislature.

Mr. Sessions resigned as a member of the Examining Committee of the Agricultural College, and Mr. Taft was elected in his place.

Dr. Lynde presented the following resolution, which was adopted by a rising vote: —

"In view of the fact that this is the last meeting of this Board of Agriculture with the Hon. John E. Russell, who for seven years has discharged the duties of Secretary of the Board, to the entire acceptance of every member, we tender to him our thanks and assurance of our personal regard and our best wishes for his happiness, success and future prosperity in life."

Voted, That the Committee on Legislation, Messrs. Moore, Stockwell and Goddard, be instructed to procure legislation to allow the printing of 12,000 additional copies of the Report of the Experiment Station, the same to be bound with the Report on Agriculture.

All papers lying upon the table were taken up, read by their titles and adopted.

Voted, That all unfinished business be referred to the Executive Committee with full powers.

Adjourned.

JOHN E. RUSSELL,
Secretary.

THE FINANCES OF THE SOCIETIES.

FINANCES OF THE SOCIETIES.

SOCIETIES.	Amount received from the Commonwealth.	Income from Permanent Fund.	New Members and Donations.	All other Sources.	Receipts for the Year.	Premiums Offered.	Premiums and Gratuities Paid.	Current Expenses for the Year, not including Premiums and Gratuities Paid.	Disbursements for the Year.	Indebtedness.	Value of Real Estate.	Value of Personal Estate.	Permanent Fund.
Amesbury and Salisbury,	$269 25	$54 40	$138 25	$397 05	$858 95	$510 00	$309 50	$304 81	$614 31	-	-	$1,981 37	$1,681 37
Barnstable,	600 00	12 00	180 05	1,665 02	2,457 07	1,441 25	1,031 67	1,198 60	2,230 27	-	$5,000 00	500 00	5,500 00
Berkshire,	600 00	417 85	190 00	3,206 46	1,414 31	3,360 00	2,939 59	1,407 22	4,346 81	$1,200 00	8,000 00	67 50	8,000 00
Bristol,	600 00	-	501 10	-	13,643 17	5,400 00	4,777 15	4,687 61	13,744 93	14,000 00	46,000 00	300 00	46,300 00
Blackstone Valley,	418 87	-	91 00	52 00	1,732 63	481 25	465 00	553 24	1,618 24	700 00	3,000 00	250 00	3,000 00
Deerfield Valley,	600 00	-	142 00	703 10	1,445 10	850 00	728 70	716 40	1,445 10	-	8,080 00	800 00	8,880 00
Essex,	600 00	985 61	218 50	342 00	2,146 11	3,151 00	1,508 75	902 45	2,411 20	-	5,000 00	1,000 00	18,303 05
Franklin,	600 00	12 11	159 00	1,687 06	2,458 17	991 25	856 38	1,360 26	2,216 64	-	10,000 00	1,000 00	11,000 00
Hampden,	600 00	-	37 00	64 00	701 00	2,136 75	565 40	285 27	850 67	-	-	-	-
Hampden East,	600 00	-	125 91	887 35	-	1,336 25	999 50	747 48	1,746 98	75 00	5,000 00	-	5,000 00
Hampshire,	600 00	-	193 32	669 04	1,462 36	873 00	720 99	653 79	1,374 78	1,100 00	4,100 00	237 50	3,237 50
Hampshire, Franklin and Hampden,	600 00	321 75	69 00	2,488 71	3,479 46	1,224 50	737 63	1,427 09	2,775 24	5,623 33	7,830 00	941 48	8,771 48
Highland,	600 00	-	54 00	1,202 73	1,856 73	899 80	638 85	1,183 80	1,822 65	-	3,000 00	-	300 00
Hingham,	600 00	-	143 00	3,001 50	3,744 50	1,656 30	700 17	3,074 33	3,745 28	400 00	16,000 00	2,000 00	16,000 00
Hoosac Valley,	600 00	-	356 00	2,735 53	3,691 53	1,777 50	1,386 75	2,351 82	4,292 12	3,000 00	12,900 00	450 00	13,350 00
Housatonic,	600 00	1,166 76	208 00	4,392 55	6,367 31	3,822 00	3,249 50	3,309 53	6,559 03	-	8,500 00	1,243 31	9,743 31
Hillside,	600 00	112 67	119 49	081 20	1,813 36	670 00	617 75	1,082 06	1,699 81	660 00	4,217 50	319 85	3,877 35
Marshfield,	600 00	-	333 50	2,250 93	3,084 43	1,175 50	1,124 66	2,112 75	3,237 41	4,652 98	11,806 92	1,392 78	7,153 94
Martha's Vineyard,	600 00	201 70	12 00	238 32	1,052 02	863 00	724 40	364 85	1,089 25	-	2,200 00	1,150 00	3,000 00
Middlesex,	600 00	-	67 00	-	2,345 80	1,560 00	721 50	1,434 42	2,155 92	21,730 00	15,000 00	-	3,760 00
Middlesex North,	600 00	710 00	46 00	889 50	2,417 10	1,206 15	808 50	1,609 20	2,084 64	1,700 00	25,000 00	200 00	20,000 00
Middlesex South,	600 00	-	54 40	1,375 03	2,029 43	1,145 50	644 60	745 22	1,409 22	14,500 00	18,000 00	1,900 00	5,400 00
Nantucket,	567 75	50 00	138 73	380 61	1,137 09	1,267 92	616 55	448 28	1,064 83	513 00	3,000 00	200 00	3,200 00
Plymouth,	600 00	200 00	332 70	6,259 86	6,592 56	2,855 50	2,288 50	3,763 11	6,051 61	9,400 00	43,000 00	2,000 00	40,000 00
Union,	600 00	-	119 37	1,419 25	2,093 25	1,457 75	989 33	1,407 99	2,397 32	-	7,051 28	1,988 50	9,039 78
Worcester,	600 00	690 78	815 00	2,298 85	4,404 63	3,226 00	2,340 43	2,012 62	-	40,000 00	120,000 00	8,000 00	-

Worcester North, .	600 00	-	152 00	1,667 22	2,419 22	1,520 50	1,243 40	1,099 84	2,191 24	11,613 63	16,000 00	200 00	220 00
Worcester North-west, . .	600 00	-	77 50	2,908 29	3,585 79	1,792 75	1,270 89	1,305 43	3.576 32	2,300 00	13,000 00	966 59	11,666 59
Worcester South, .	600 00	3,199 16	250 00	400 00	4,449 00	2,600 00	2,145 50	1,308 70	4,785 21	124 15	15,300 00	1,000 00	15,300 00
Worcester West, .	600 00	1,222 05	257 45	254 50	2,334 00	1,503 50	1,217 60	624 21	2,604 81	400 00	11,600 00	750 00	11,600 00
Massachusetts Horticultural, . .	600 00	-	570 00	38,330 00	39,500 00	6,743 00	4,484 00	26,800 00	31,284 00	42,000 00	240,000 00	42,231 68	180,000 00
	$18,055 87	$9,356 84	$6,151 27	$83,147 66	$126,716 08	$59,497 92	$42,853 14	$70,282 38	$117,425 84	$175,692 09	$687,585 70	$73,170 56	$473,284 37

PERMANENT FUND — HOW INVESTED.

AMESBURY AND SALISBURY. — Deposited in bank.
BARNSTABLE. — Real estate and government bonds.
BERKSHIRE. — Real estate.
BLACKSTONE VALLEY. — Real estate.
BRISTOL. — Real estate.
DEERFIELD VALLEY. — Bank funds and real estate.
ESSEX. — Bank stock and farm.
FRANKLIN. — Bank stock and real estate.
HAMPDEN. —
HAMPDEN EAST. — In land and buildings.
HAMPSHIRE. — In real estate.
HAMPSHIRE, FRANKLIN AND HAMPDEN. — In real estate and personal property.
HIGHLAND. — Real estate.
HILLSIDE. — In land and buildings.
HINGHAM. — In land and buildings.
HOOSAC VALLEY. — Real estate.
HOUSATONIC. — Real estate, railroad bonds, bank funds.
MARSHFIELD. — In land and buildings.
MARTHA'S VINEYARD. — In land and buildings.
MASSACHUSETTS HORTICULTURAL. — In real estate.
MIDDLESEX. —
MIDDLESEX NORTH. — In land and buildings.
MIDDLESEX SOUTH. — In land and buildings.
NANTUCKET. — In land and buildings.
PLYMOUTH. — In real estate.
UNION. — Real estate and cash.
WORCESTER. — Real estate.
WORCESTER NORTH. — Real estate and cash.
WORCESTER NORTH-WEST. — In land and buildings.
WORCESTER SOUTH. — In land and buildings.
WORCESTER WEST. — In real estate.

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED.

SOCIETIES.	Total Amount offered for Management and Improvement of Farms, Orchards, etc.	Total Amount paid for Management and Improvement of Farms, Orchards, etc.	For Neat and Dairy Stock.	For Horses.	For all other Farm Stock.	Total Amount offered for Live Stock.	Total Amount paid out for Live Stock.	For Cereals and Seeds.	For Roots and Vegetables.	Total Amount offered for Grain and Root Crop.	Total Amount paid out for Grain and Root Crop.	For Fruits, Flowers, etc.	For Dairy Products.	For Bread, Honey, and Preserved Fruits.	Total Amount paid out under the head of Farm Products.
Amesbury and Salisbury, . .	$100 00	$50 00	-	-	$15 00	$25 00	$15 00	$13 50	$22 25	$111 00	$37 75	$54 50	$7 00	$5 75	$114 50
Barnstable, . .	154 00	50 00	$133 00	$69 00	130 25	418 00	332 25	31 20	81 47	155 75	112 67	91 35	16 00	35 50	255 52
Berkshire, . .	203 00	202 00	393 00	211 00	263 50	1,149 00	867 50	189 00	127 75	339 00	316 75	95 50	44 00	88 25	544 50
Bristol, . . .	215 00	149 00	717 00	245 00	238 00	1,700 00	1,200 00	46 00	106 00	275 00	152 00	207 00	26 00	31 00	416 00
Blackstone Valley,	80 00	78 00	122 50	46 00	74 50	257 75	237 00	8 50	14 25	26 75	22 75	24 75	6 00	9 75	62 25
Deerfield Valley, .	-	-	188 00	134 00	175 65	615 00	497 65	5 37	7 25	21 25	12 62	37 97	7 00	19 25	76 84
Essex, . . .	330 00	149 00	242 00	245 00	105 00	1,674 00	508 00	34 00	141 50	445 00	85 00	504 25	24 00	16 00	636 75
Franklin, . .	-	-	243 00	118 50	180 50	627 75	529 50	15 00	43 00	65 00	63 00	99 00	16 00	22 13	183 13
Hampden, . .	308 00	38 00	115 00	80 00	83 00	991 50	249 50	14 00	53 75	289 75	73 89	155 00	10 00	14 75	220 40
Hampden East, .	-	-	164 00	118 00	97 50	520 00	379 50	12 25	55 00	87 50	51 75	40 00	21 50	10 50	113 75
Hampshire, . .	22 00	22 00	114 00	95 00	155 25	413 00	364 25	8 50	22 00	47 00	41 00	84 00	11 00	21 00	162 00
Hampshire, Franklin and Hampden,	20 00	-	257 00	160 00	112 50	604 00	479 25	13 50	40 50	231 00	49 00	83 75	26 00	22 50	158 75
Highland, . .	40 00	22 00	152 50	128 00	105 50	582 50	386 00	20 50	15 50	47 00	36 00	37 90	7 00	12 70	93 60

Hingham, . .	234 75	17 00	199 25	45 00	176 20	787 25	420 42	-	33 70	187 00	33 70	116 62	8 75	20 60	179 60
Hoosac Valley, .	75 00	68 00	165 00	157 00	246 50	796 00	559 50	142 00	77 75	235 00	219 75	95 50	42 50	45 00	402 75
Housatonic, . .	212 00	159 00	452 00	233 00	595 00	1,527 00	1,262 00	341 00	70 00	609 00	432 00	143 00	90 00	89 00	761 00
Hillside, . .	40 00	32 00	153 00	113 00	87 00	383 00	353 00	21 00	16 75	40 00	40 00	35 20	15 00	31 00	103 00
Marshfield, . .	73 00	29 00	142 00	86 25	98 00	482 50	326 25	-	63 75	99 00	-	96 60	16 00	37 50	213 85
Martha's Vineyard,	54 00	29 00	122 25	88 50	154 75	584 25	365 50	51 00	56 50	129 00	62 00	34 11	18 00	25 10	184 71
Middlesex, . .	-	-	88 00	68 00	209 50	580 00	263 00	6 75	57 00	103 50	33 00	236 50	2 00	36 00	250 25
Middlesex North, .	10 00	10 00	197 00	121 00	81 50	692 00	372 50	16 00	43 00	146 00	81 50	158 25	8 00	35 25	161 50
Middlesex South, .	45 00	24 00	118 00	53 00	116 50	519 00	275 50	11 25	26 25	172 00	35 75	67 20	6 00	24 00	128 25
Nantucket, . .	123 00	-	153 00	78 50	64 50	-	296 00	20 00	33 50	225 75	23 00	66 50	15 00	23 00	429 75
Plymouth, . .	55 00	-	441 00	122 00	209 00	948 00	7 72	98 00	85 00	196 25	142 50	173 00	36 00	24 25	416 25
Union, . . .	11 00	-	195 50	101 00	153 50	795 25	430 50	17 50	19 00	74 50	51 50	34 00	13 25	7 00	108 50
Worcester, . .	-	-	293 00	230 00	91 00	1,488 00	694 00	37 00	77 00	173 00	156 00	260 00	31 00	12 00	-
Worcester North, .	-	20 00	135 00	74 50	83 00	459 00	264 50	11 25	14 00	37 75	25 00	74 00	11 00	12 75	138 25
Worcester Northwest, . . .	22 00	16 00	333 00	141 00	100 00	903 50	566 83	31 00	14 00	63 00	45 00	45 00	15 00	12 00	106 92
Worcester South, .	40 00	40 00	653 00	208 00	139 80	1,213 00	968 00	16 00	21 30	122 00	80 00	90 75	32 00	32 00	474 05
Worcester West, .	33 00	21 00	328 00	164 00	71 00	744 00	550 75	9 00	14 25	79 00	23 25	30 25	22 00	15 25	89 50
Mass. Horticultural, . . .	700 00	100 00	-	-	-	-	-	95 00	169 00	382 00	150 00	5,517 00	-	-	4,384 00
	$3,199 75	$1,325 00	$7,009 00	$3,733 25	$4,412 90	$22,479 25	$14,785 65	$1,335 07	$1,621 97	$5,214 75	$2,678 13	$8,798 45	$603 00	$790 78	$11,570 12

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED. — *Concluded.*

SOCIETIES.	For Agricultural Implements.	Offered for raising Forest Trees.	For Experiments in Manures.	Amount awarded for Objects strictly Agricultural not already specified.	Amount awarded and paid out for Trotting Horses.	For Objects not strictly Agricultural: Domestic Manufactures.	Number of Persons who received Premiums and Gratuities.
Amesbury and Salisbury, ...	$25 00	$10 00	$15 00	–	–	$94 00	150
Barnstable, . . .	–	30 00	–	–	$230 00	163 90	487
Berkshire, . . .	35 00	–	–	$61 00	750 00	479 59	749
Bristol, ...	150 00	23 00	60 00	–	1,746 00	725 00	445
Blackstone Valley, .	–	–	–	–	–	94 50	162
Deerfield Valley, . .	–	–	–	6 50	50 00	197 71	300
Essex, ...	47 00	30 00	25 00	127 00	–	166 00	357
Franklin, . . .	–	10 00	–	–	397 00	145 85	260
Hampden, . . .	52 00	30 00	15 00	–	–	45 75	115
Hampden East, . .	–	25 00	–	1 50	405 00	101 25	146
Hampshire, . . .	15 00	8 00	–	55 00	185 00	102 74	154
Hampshire, Franklin and Hampden, . .	19 00	20 00	–	–	371 25	104 50	164
Highland, . . .	–	–	–	–	37 00	100 25	206
Hingham, . . .	–	63 75	–	–	–	82 65	315
Hoosac Valley, . .	28 00	–	10 00	28 50	1,040 00	264 50	290
Housatonic, . . .	–	–	–	33 00	685 00	353 50	473
Hillside, . . .	–	–	–	–	–	122 85	317
Marshfield, . . .	–	50 00	–	–	412 00	143 90	475
Martha's Vineyard, .	2 00	11 00	10 00	–	–	116 19	200
Middlesex, . . .	–	50 00	–	28 00	135 00	77 00	148
Middlesex North, . .	3 00	–	–	–	–	26 25	253
Middlesex South, . .	–	30 00	–	48 30	125 00	43 55	145
Nantucket, . . .	–	21 00	–	–	–	118 30	250
Plymouth, . . .	8 00	–	–	10 00	834 00	192 25	399
Union, ...	6 00	–	–	28 55	290 00	139 90	231
Worcester, . . .	14 00	11 00	–	–	1,075 00	83 00	168
Worcester North, .	19 00	25 00	–	25 00	390 00	232 15	217
Worcester North-west,	2 00	30 00	–	–	540 00	55 85	142
Worcester South, .	9 50	40 00	–	13 00	575 00	196 35	207
Worcester West, . .	8 00	30 00	10 00	–	490 00	73 50	210
Mass. Horticultural, .	–	10 00	–	–	–	–	167
	$442 50	$557 75	$145 00	$466 35	$10,762 25	$4,842 73	8,302

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President—WM. L. BROWN of North Adams.
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Secretary—S. BOTHWELL of Barre.

WORCESTER SOUTH.

President—WALDO JOHNSON of Webster.
Secretary—C. V. COREY of Sturbridge.

AGRICULTURAL EXHIBITIONS, 1887.

AMESBURY AND SALISBURY at *Amesbury*, October 4 and 5.
BAY STATE (date not given).
BARNSTABLE at *Barnstable*, September 27 and 28.
BERKSHIRE at *Pittsfield*, September 13 and 14.
BLACKSTONE VALLEY at *Uxbridge*, September 27 and 28.
BRISTOL at *Taunton*, September 27, 28 and 29.
DEERFIELD VALLEY at *Charlemont*, September 15 and 16.
ESSEX at *Peabody*, September 27 and 28.
FRANKLIN at *Greenfield*, September 29 and 30.
HAMPDEN at *West Springfield*, September 21 and 22.
HAMPDEN EAST at *Palmer*, September 13 and 14.
HAMPSHIRE at *Amherst*, September 22 and 23.
HAMPSHIRE, FRANKLIN AND HAMPDEN at *Northampton*, October 5 and 6.
HIGHLAND at *Middlefield*, September 7 and 8.
HINGHAM at *Hingham*, September 27 and 28.
HOOSAC VALLEY at *North Adams*, September 20, 21 and 22.
HOUSATONIC at *Great Barrington*, September 28 and 29.
HILLSIDE at *Cummington*, September 27 and 28.
MASSACHUSETTS HORTICULTURAL, September 13, 14 and 15.
MARSHFIELD at *Marshfield*, September 14, 15 and 16.
MARTHA'S VINEYARD at *West Tisbury*, October 4 and 5.
MIDDLESEX at *Concord*, September 27 and 28.
MIDDLESEX NORTH at *Lowell*, September 21 and 22.
MIDDLESEX SOUTH at *Framingham*, September 20 and 21.
NANTUCKET at *Nantucket*, September 7 and 8.
PLYMOUTH at *Bridgewater*, September 21 and 22.
UNION at *Blandford*, September 14 and 15.
WORCESTER at *Worcester*, September 6 and 7 (this year only).
WORCESTER NORTH at *Fitchburg*, September 27 and 28.
WORCESTER NORTH-WEST at *Athol*, September 20 and 21.
WORCESTER SOUTH at *Sturbridge*, September 15 and 16.
WORCESTER WEST at *Barre*, September 29 and 30.

APPENDIX.

FOURTEENTH ANNUAL REPORT

ON

COMMERCIAL FERTILIZERS.

By C. A. Goessmann, *State Inspector.*

The consumption of commercial fertilizers is apparently, from year to year, still increasing. Lower prices and better returns, in consequence of a more judicious selection to meet the deficiency of the soil under cultivation, tend to increase the demand.

Most of our standard fertilizers have maintained their good reputation, as far as a satisfactory mechanical condition and a fair compliance with the guaranteed composition are concerned. The reduction in the cost of soluble phosphoric acid, of the best forms of organic nitrogen and of the sulphate of potash has not infrequently lowered their valuation from three to four dollars per ton, as compared with that of the preceding years. The lower grades of compound fertilizers have proved, as on previous occasions, the more costly articles for the consumer. The unusual large margin of this class of fertilizers has, no doubt, misled consumers in their choice. Some farmers seem to forget that the responsibility of the dealer ceases with furnishing an article of the lowest stated guaranty. No redress can be secured by law as long as the analysis shows that the composition of the article is still within the lowest guaranty, however inferior and worthless it may be.

The only safe course for farmers to pursue is to discard all fertilizers which are offered for sale without a printed guaranty of composition on each package; and to look with suspicion, at least, upon all fertilizers with a wide margin in the guaranteed composition, until otherwise convinced that the article is worth the amount charged.

The samples of fertilizers which served for the analyses reported upon subsequent pages have been collected, with but two or three exceptions, in the general markets and in accordance with our State laws, by a responsible and competent party.

Valuation of Fertilizers.

The valuation which accompanies the analysis of a fertilizer should inform the consumer, as far as practicable, regarding the cash retail price at which the several specified elements of plant food, in an efficient form, have been offered for sale in our principal markets at the beginning of the season.

The market value of manurial substances, as bones, salt, ashes, various compounds of lime, barnyard manure, factory refuse and waste materials of different description, quite frequently does not stand in a close relation to their chemical composition. Their cost varies in different localities. Local facilities for cheap transportation, and more or less advantageous mechanical condition for a speedy action, exert, as a rule, a decided influence on their selling price.

The market reports of centres of trade in New England, New York and New Jersey, aside from consultations with leading manufacturers of fertilizers, have furnished us the necessary information regarding the current trade value of fertilizing ingredients.

The subsequent statement of cash values in the retail trade is obtained by taking the average of the wholesale quotations in New York and Boston during the six months preceding March 1, 1886, and increasing them 20 per cent., to cover expenses for sales, credits, etc.

These trade values, except those for phosphoric acid soluble in ammonium citrate, were agreed upon by the Experiment Stations of Massachusetts, Connecticut and New Jersey, for use in their several States for the last season.

Trade Values of Fertilizing Ingredients in Raw Materials and Chemicals.

	1886. Cents per pound
Nitrogen in ammonia salts,	18½
Nitrogen in nitrates,	18½
Nitrogen in dried and fine ground fish,	17
Organic nitrogen in guano, and fine ground blood and meat,	17
Organic nitrogen in cotton seed, linseed meal and in castor pomace,	17
Organic nitrogen in fine ground bone,	17
Organic nitrogen in fine medium bone,	15
Organic nitrogen in medium bone,	13
Organic nitrogen in coarse medium bone,	11
Organic nitrogen in coarse bone, horn shavings, hair and fish scraps,	9
Phosphoric acid, soluble in water,	8
Phosphoric acid, soluble in ammonia citrate,*	7½
Phosphoric acid, insoluble in fine ground fish, and in fine bone,	7
Phosphoric acid, insoluble in fine medium bone,	6
Phosphoric acid, insoluble in medium bone,	5
Phosphoric acid, insoluble in coarse medium bone,	4
Phosphoric acid, insoluble in coarse bone,	3
Phosphoric acid, insoluble in fine ground rock phosphate,	2
Potash, as high grade sulphate,	5½
Potash, as kainite,	4¼
Potash, as muriate,	4¼

The above trade values are the figures at which, on March 1st, the respective ingredients could be bought at retail for cash, per pound, in our leading markets, in raw materials, which are the regular source of supply.

They also correspond to the average wholesale prices for the six months ending March 1st, plus 20 per cent. in case of goods for which we have wholesale quotations. The calculated values obtained by the use of the above figures will be found to agree fairly with the reasonable retail price in case of standard raw materials, such as Sulphate of Ammonia, Dry Ground Fish, Nitrate of Soda, Castor Pomace, Muriate of Potash, Cotton Seed, Sulphate of Potash, Bone, Dried Blood, Azotin, Plain Superphosphates.

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* Dissolved from two grains of phosphate, unground, by 100 C.C. neutral solution of ammonium citrate, sp. gr. 1 09, in 30 minutes at 65° C., with agitation once in five minutes; commonly called "reverted" or "backgone" phosphoric acid.

Trade Values in Superphosphates, Special Manures and Mixed Fertilizers of High Grade.

The organic nitrogen in these classes of goods is valued at the highest figure laid down in the Trade Values of Fertilizing Ingredients in Raw Materials, viz., seventeen cents per pound; it being assumed that the organic nitrogen is derived from the *best* source, viz., bone, blood, animal matter or other equally good forms, and *not* from leather shoddy, hair or any low-priced inferior form of vegetable matter, unless the contrary is ascertained.

Insoluble phosphoric acid is valued at three cents, it being assumed, unless found otherwise, that it is from bone or similar source, and not from rock phosphate. In this latter form the insoluble phosphoric acid is worth but two cents per pound. Potash is rated at four and one-quarter cents, if sufficient chlorine is present in the fertilizer to combine with it to make muriate; and also in cases where no distinct form of potash is specified.

To introduce large quantities of chlorides, as common salt, etc., into a fertilizer claiming sulphate of potash as a constituent, is a practice which in our present state of information ought to be considered as of doubtful merit. The use of the highest trade values is but justice in the articles in which the most efficient, and thus costliest, materials are expected to be used.

In most cases the valuation of the ingredients in superphosphates and specials falls below the retail price of these goods. The difference between the two figures represents the manufacturers' charges for converting raw materials into manufactured articles. These charges are for grinding and mixing, bagging or barrelling, storage, transportation, commission to agents and dealers, long credits, interest on investments, bad debts, and finally profits.

The prices stated in this report in connection with analyses of commercial fertilizers refer to their cost per ton of 2,000 pounds on board of cars or boat near the factory or the place for general distribution.

Bridges' Fish and Potash.

(Collected of B. F. Bridges, So. Deerfield, Mass.)

Guaranteed composition: Total phosphoric acid, 3 to 4 per cent.; potassium oxide, 3 to 4 per cent.; nitrogen, 2¾ to 4 per cent.

	Per cent.
Moisture at 100° C.,	26.18
Total phosphoric acid,	3.69
Soluble phosphoric acid,	.96
Reverted phosphoric acid,	2.05
Insoluble phosphoric acid,	.68
Potassium oxide,	3.69
Nitrogen,	4.07
Insoluble matter,	2.20

Valuation per two thousand pounds: —

19.2 pounds of soluble phosphoric acid,	$1 54
41. pounds of reverted phosphoric acid,	3 08
13.6 pounds of insoluble phosphoric acid,	41
73.8 pounds of potassium oxide,	3 14
81.4 pounds of nitrogen,	13 84
	$22 01

Standard Superphosphate.

(Standard Fertilizer Company, Boston; collected of Joseph Breck & Sons, Boston, Mass.)

Guaranteed composition: Available phosphoric acid, 9 to 13 per cent.; insoluble phosphoric acid, 2 to 3 per cent.; potassium oxide, 2 to 4 per cent.; nitrogen, 2.5 to 3.3 per cent. (equivalent to ammonia, 3 to 4 per cent.).

	Per cent.
Moisture at 100° C.,	12.65
Total phosphoric acid,	12.25
Soluble phosphoric acid,	7.87
Reverted phosphoric acid,	2.42
Insoluble phosphoric acid,	1.96
Potassium oxide,	1.93
Nitrogen,	3.37
Insoluble matter,	4.15

Valuation per two thousand pounds: —

157.4 pounds of soluble phosphoric acid,	$12 59
48.4 pounds of reverted phosphoric acid,	3 63
39.2 pounds of insoluble phosphoric acid,	1 18
38.6 pounds of potassium oxide,	1 74
67.4 pounds of nitrogen,	11 46
	$30 60

Williams, Clark & Co.'s "Americus" Ammoniated Superphosphate.

(Collected of John Sullivan, Northampton, Mass.)

Guaranteed composition: Total phosphoric acid, 11 to 13 per cent.; soluble phosphoric acid, 7 to 8 per cent.; reverted phosphoric acid, 3 to 4 per cent.; insoluble phosphoric acid, 1 to 3 per cent.; potassium sulphate, 2 to 3 per cent.; ammonia, 3 to 4 per cent. (equivalent to nitrogen, 2.5 to 3.3 per cent.); magnesium sulphate, 3 to 4 per cent.

	Per cent.
Moisture at 100° C.,	9.50
Total phosphoric acid,	13.85
Soluble phosphoric acid,	10.36
Reverted phosphoric acid,	2.44
Insoluble phosphoric acid,	1.05
Potassium oxide,	2.58
Nitrogen,	3.28
Insoluble matter,	1.53

Valuation per two thousand pounds: —

207.2 pounds of soluble phosphoric acid,	$16 58
48.8 pounds of reverted phosphoric acid,	3 66
21. pounds of insoluble phosphoric acid,	63
51.6 pounds of potassium oxide,	2 84
65.6 pounds of nitrogen,	11 15
	$34 86

Bradley's "Original Coe" Superphosphate of Lime.

(Collected of D. J. Wright, Northampton, Mass.)

Guaranteed composition: Total phosphoric acid, 11 to 14 per cent.; soluble phosphoric acid, 7 to 8 per cent.; reverted phosphoric acid, 2 to 3 per cent.; available phosphoric acid, 9 to 11 per cent.; insoluble phosphoric acid, 2 to 3 per cent.; nitrogen, 2.05 to 2.85 per cent. (equivalent to ammonia, 2.5 to 3.5 per cent.).

	Per cent.
Moisture at 100° C.,	13.50
Total phosphoric acid,	13.84
Soluble phosphoric acid,	8.00
Reverted phosphoric acid,	3.33
Insoluble phosphoric acid,	2.51
Nitrogen,	3.47
Insoluble matter,	5.68

Valuation per two thousand pounds : —

160. pounds of soluble phosphoric acid,	$12 80
66 6 pounds of reverted phosphoric acid,	5 00
50.2 pounds of insoluble phosphoric acid,	1 51
69.4 pounds of nitrogen,	11 80
	$31 11

Bradley's XL Superphosphate.

(Collected of D. J. Wright, Northampton, Mass)

Guaranteed composition : Total phosphoric acid, 11 to 14 per cent. ; soluble phosphoric acid, 7 to 8 per cent. ; reverted phosphoric acid, 2 to 3 per cent. ; available phosphoric acid, 9 to 11 per cent. ; potassium oxide, 2 to 3 per cent. (equivalent to potassium sulphate, 3.77 to 5.55 per cent.) ; nitrogen, 2.5 to 3.25 per cent. (equivalent to ammonia, 3 to 4 per cent.).

	Per cent.
Moisture at 100° C.,	13 80
Total phosphoric acid,	12.45
Soluble phosphoric acid,	8.16
Reverted phosphoric acid,	.94
Insoluble phosphoric acid,	3.35
Potassium oxide,	2.86
Nitrogen,	2.77
Insoluble matter,	6 15

Valuation per two thousand pounds : —

162 2 pounds of soluble phosphoric acid,	$13 06
18.8 pounds of reverted phosphoric acid,	1 41
67. pounds of insoluble phosphoric acid,	2 01
57.2 pounds of potassium oxide,	3 15
55.4 pounds of nitrogen,	9 42
	$29 05

Williams, Clark & Co.'s "Americus" for Potatoes.

(Collected of John Sullivan, Northampton, Mass.)

Guaranteed composition : Total phosphoric acid, 7 to 10 per cent. ; soluble phosphoric acid, 5 to 6 per cent. ; reverted phosphoric acid, 1 to 2 per cent. ; insoluble phosphoric acid, 1 to 2 per cent. ; potassium oxide, 8 to 10 per cent. (equivalent to potassium sulphate, 15 to 18 per cent.) ; ammonia, 4 to 5 per cent. (equivalent to nitrogen, 3.3 to 4.1 per cent.).

	Per cent.
Moisture at 100° C.,	8.23
Total phosphoric acid,	10.45
Soluble phosphoric acid,	7.68
Reverted phosphoric acid,	1.64
Insoluble phosphoric acid,	1.03
Potassium oxide (sulphate),	8.50
Nitrogen,	4.37
Insoluble matter,	1.20

Valuation per two thousand pounds:—

153.6 pounds of soluble phosphoric acid,	$12 29
32.8 pounds of reverted phosphoric acid,	2 46
20.6 pounds of insoluble phosphoric acid,	62
170. pounds of potassium oxide,	9 35
87.4 pounds of nitrogen,	14 86
	$39 58

Williams, Clark & Co.'s "Americus" for Tobacco.

(Collected of John Sullivan, Northampton, Mass.)

Guaranteed composition: Total phosphoric acid, 5 to 6 per cent.; soluble phosphoric acid, 3 to 4 per cent.; reverted phosphoric acid, 1 to 2 per cent.; insoluble phosphoric acid, 1 to 2 per cent.; potassium oxide, 7 to 8 per cent. (equivalent to potassium sulphate, 13 to 15 per cent.); ammonia, 6 to 7 per cent. (equivalent to nitrogen, 5 to 5.8 per cent.).

	Per cent.
Moisture at 100° C.,	9.18
Total phosphoric acid,	7.54
Soluble phosphoric acid,	5.12
Reverted phosphoric acid,	1.84
Insoluble phosphoric acid,	.58
Potassium oxide,	8.41
Nitrogen,	4.00
Insoluble matter,	2.60

Valuation per two thousand pounds:—

102.4 pounds of soluble phosphoric acid,	$8 19
36.8 pounds of reverted phosphoric acid,	2 76
11.6 pounds of insoluble phosphoric acid,	35
168.2 pounds of potassium oxide,	9 25
48. pounds of nitrogen (in organic matter),	8 16
32. pounds of nitrogen (in ammonia salts),	5 92
	$34 63

Chittenden's Fish and Potash.

(National Fertilizer Company, Bridgeport, Conn.; collected of Slate & DeWolf, Greenfield, Mass)

Guaranteed composition: Total phosphoric acid, 6 to 8 per cent.; potassium oxide, 3 to 4 per cent.; ammonia, 4 to 5 per cent. (equivalent to nitrogen, 3.3 to 4.1 per cent.).

	Per cent.
Moisture at 100° C.,	18.83
Total phosphoric acid,	9.28
Soluble phosphoric acid,	.61
Reverted phosphoric acid,	5.45
Insoluble phosphoric acid,	3 22
Potassium oxide,	6.33
Nitrogen,	4.13
Insoluble matter,	–

Valuation per two thousand pounds: —

12.2 pounds of soluble phosphoric acid,	$ 98
109. pounds of reverted phosphoric acid,	8 18
64 4 pounds of insoluble phosphoric acid,	1 93
126.6 pounds of potassium oxide,	5 38
82 6 pounds of nitrogen,	14 04
	$30 51

H. L. Phelps' Complete Manure. (*Swift Sure Guano and Potash.*)

(Manufactured by M. L. Shoemaker & Co , Philadelphia, Pa.; collected of Slate & DeWolf, Greenfield, Mass.)

Guaranteed composition: Soluble and reverted phosphoric acid, 3 to 4 per cent.; insoluble phosphoric acid, 4 to 5 per cent.; potassium oxide, 5 to 6 per cent.; ammonia, 4 to 5 per cent. (equivalent to nitrogen, 3.3 to 4.1 per cent.).

	Per cent.
Moisture at 100° C.,	8.15
Total phosphoric acid,	9.07
Soluble phosphoric acid,	2.59
Reverted phosphoric acid,	2.27
Insoluble phosphoric acid,	4 21
Potassium oxide,	4.92
Nitrogen,	3.23
Insoluble matter,	3.23

Valuation per two thousand pounds: —

51.8 pounds of soluble phosphoric acid,	$4 14
45.4 pounds of reverted phosphoric acid,	3 41
84.2 pounds of insoluble phosphoric acid,	2 52
98.4 pounds of potassium oxide,	4 18
57.4 pounds of nitrogen (in organic matter),	9 76
2. pounds of nitrogen (in ammonia salts),	37
5.2 pounds of nitrogen in nitrates,	96
	$25 34

Crocker's Potato, Hop and Tobacco Fertilizer.

(Collected of Slate & DeWolf, Greenfield, Mass.)

Guaranteed composition: Soluble phosphoric acid, 6 to 8 per cent.; precipitated phosphoric acid, 2 to 4 per cent.; insoluble phosphoric acid, 1 to 2 per cent.; potassium sulphate, 6 to 8 per cent. (equivalent to potassium oxide, 2.9 to 3 per cent.); ammonia, 2.5 to 3.5 per cent. (equivalent to nitrogen, 2 to 2.9 per cent.).

	Per cent.
Moisture at 100° C,	13.39
Total phosphoric acid,	12.95
Soluble phosphoric acid,	8.09
Reverted phosphoric acid.	2.29
Insoluble phosphoric acid,	2.57
Potassium oxide,	3.54
Nitrogen,	2.63
Insoluble matter,	3.95

Valuation per two thousand pounds: —

161.8 pounds of soluble phosphoric acid,	$12 94
45.8 pounds of reverted phosphoric acid,	3 44
51.4 pounds of insoluble phosphoric acid.	1 54
70.8 pounds of potassium oxide,	3 89
52.6 pounds of nitrogen,	8 94
	$30 75

Chittenden's Complete Fertilizer (Tobacco).

(Collected of Slate & DeWolf, Greenfield, Mass.)

Guaranteed composition: Total phosphoric acid, 8 to 10 per cent.; available phosphoric acid, 6 to 8 per cent.; potassium oxide (sulphate), 8 to 10 per cent.; ammonia, 4 to 6 per cent. (equivalent to nitrogen, 3.3 to 5 per cent.).

	Per cent.
Moisture at 100° C.,	11.03
Total phosphoric acid.	9.60
Soluble phosphoric acid.	6.43
Reverted phosphoric acid,	1.33
Insoluble phosphoric acid.	1.84
Potassium oxide,	7.94
Nitrogen,	4.23
Insoluble matter,	1.10

Valuation per two thousand pounds : —

128.6 pounds of soluble phosphoric acid,	$10 29
26.6 pounds of reverted phosphoric acid,	2 00
36.8 pounds of insoluble phosphoric acid,	1 10
158.8 pounds of potassium oxide,	8 73
84.6 pounds of nitrogen,	14 38
	$36 50

Chittenden's Universal Phosphate.

(National Fertilizer Company, Bridgeport, Conn.; collected of Slate & DeWolf, Greenfield, Mass.)

Guaranteed composition : Total phosphoric acid, 10 to 12 per cent. ; soluble and reverted phosphoric acid, 8 to 10 per cent. ; potassium oxide, 2 to 4 per cent. ; ammonia, 2.5 to 3.5 per cent. (equivalent to nitrogen, 2 to 2.9 per cent.).

	Per cent.
Moisture at 100° C.,	13.06
Total phosphoric acid,	11.75
Soluble phosphoric acid,	5.57
Reverted phosphoric acid.	3.36
Insoluble phosphoric acid.	2 82
Potassium oxide,	2.52
Nitrogen,	4.13
Insoluble matter,	1.36

Valuation per two thousand pounds : —

111.4 pounds of soluble phosphoric acid,	$8 91
67.2 pounds of reverted phosphoric acid,	5 04
56.4 pounds of insoluble phosphoric acid,	1 69
50.4 pounds of potassium oxide,	2 14
82 6 pounds of nitrogen,	14 04
	$31 82

Crocker's Ammoniated Bone Superphosphate.

(Collected of Slate & DeWolf, Greenfield, Mass.)

Guaranteed composition : Soluble phosphoric acid, 6 to 8 per cent. ; reverted phosphoric acid, 2 to 4 per cent. ; insoluble phosphoric acid, 1 to 2 per cent.; potassium oxide (sulphate), 1 to 3 per cent.; ammonia, 3.5 to 4.5 per cent. (equivalent to nitrogen, 2.9 to 3.7 per cent.).

	Per cent.
Moisture at 100° C.,	10.70
Total phosphoric acid,	11.27
Soluble phosphoric acid,	7.42
Reverted phosphoric acid,	1.98
Insoluble phosphoric acid,	1.87
Potassium oxide,	1.29
Nitrogen,	2.13
Insoluble matter,	3 98

Valuation per two thousand pounds: —

148 4 pounds of soluble phosphoric acid,	$11 87
39.6 pounds of reverted phosphoric acid,	2 97
37.4 pounds of insoluble phosphoric acid,	1 12
25.8 pounds of potassium oxide,	1 42
42 6 pounds of nitrogen,	7 24
	$24 62

H. L. Phelps' Complete Manure for Grass.

(M. L. Shoemaker & Co., Philadelphia, Pa.; collected of Slate & DeWolf, Greenfield, Mass.)

Guaranteed composition: Total phosphoric acid, 8 to 10 per cent.; soluble and reverted phosphoric acid, 4 to 5 per cent; potassium oxide, 7 to 8 per cent.; ammonia, 5 to 6 per cent. (equivalent to nitrogen, 4.1 to 5 per cent.).

	Per cent.
Moisture at 100° C.,	9.35
Total phosphoric acid,	9.48
Soluble phosphoric acid,	4.54
Reverted phosphoric acid,	2.75
Insoluble phosphoric acid,	2.06
Potassium oxide,	7.62
Nitrogen,	3.93
Insoluble matter,	1.83

Valuation per two thousand pounds: —

90 8 pounds of soluble phosphoric acid,	$7 26
55. pounds of reverted phosphoric acid,	4 13
41.2 pounds of insoluble phosphoric acid,	1 24
152.4 pounds of potassium oxide,	6 48
78.6 pounds of nitrogen,	13 36
	$32 47

Mitchell's Standard Superphosphate.

(Collected of J. & J. A. Rice, Worcester, Mass.)

Guaranteed composition: Total phosphoric acid, 11.5 to 12.5 per cent.; soluble phosphoric acid, 7.5 to 8.5 per cent.; reverted phosphoric acid, 1 to 2 per cent.; potassium oxide, 3 to 4 per cent.; ammonia, 2.5 to 3.5 per cent. (equivalent to nitrogen, 2 to 2.9 per cent.).

	Per cent.
Moisture at 100° C.,	20 48
Total phosphoric acid,	13.41
Soluble phosphoric acid,	8 16
Reverted phosphoric acid,	2.97
Insoluble phosphoric acid,	2.28
Potassium oxide,	2.03
Nitrogen,	2.00
Insoluble matter,	7.42

Valuation per two thousand pounds: —

163.2 pounds of soluble phosphoric acid,	$13 06
59.4 pounds of reverted phosphoric acid,	4 46
45.6 pounds of insoluble phosphoric acid,	1 37
40.6 pounds of potassium oxide,	1 73
40. pounds of nitrogen,	6 80
	$27 42

E. Frank Coe's Genuine Ammoniated Bone Superphosphate.

(Collected of J. S. Clark & Son, Worcester, Mass.)

Guaranteed composition: Soluble phosphoric acid, 7 to 10 per cent.; reverted and insoluble phosphoric acid, 1.5 to 3 per cent.; nitrogen, 2 to 3 per cent. (equivalent to ammonia, 2.25 to 3.5 per cent.).

	Per cent.
Moisture at 100° C.,	21.18
Total phosphoric acid,	11.01
Soluble phosphoric acid,	7.87
Reverted phosphoric acid,	1.93
Insoluble phosphoric acid,	1.21
Nitrogen,	3.12
Insoluble matter,	.50

Valuation per two thousand pounds: —

157.4 pounds of soluble phosphoric acid,	$12 59
38.6 pounds of reverted phosphoric acid,	2 90
24.2 pounds of insoluble phosphoric acid,	73
62.4 pounds of nitrogen,	10 61
	$26 83

Bay State Bone Superphosphate.

(J. A. Tucker & Co., Boston; collected of J. S. Clark & Son, Worcester, Mass.)

Guaranteed composition: Soluble phosphoric acid, 7 to 10 per cent.; reverted and insoluble phosphoric acid, 1.5 to 3 per cent.; nitrogen, 2 to 3 per cent. (equivalent to ammonia, 2.75 to 3.5 per cent.).

	Per cent.
Moisture at 100° C.,	20.60
Total phosphoric acid,	11.31
Soluble phosphoric acid,	8.22
Reverted phosphoric acid,	1.81
Insoluble phosphoric acid,	1.28
Nitrogen,	3.59
Insoluble matter,	.88

Valuation per two thousand pounds: —

164.4 pounds of soluble phosphoric acid,	$13 15
36.2 pounds of reverted phosphoric acid,	2 72
25.6 pounds of insoluble phosphoric acid,	77
71.8 pounds of nitrogen,	12 21
	$28 85

Bowker's Hill and Drill Phosphate.

(Collected of Earle & Peckham, Worcester, Mass.)

Guaranteed composition: Total phosphoric acid, 11 to 13 per cent.; soluble phosphoric acid, 8 to 10 per cent.; reverted phosphoric acid, 1 to 2 per cent.; potassium oxide (sulphate), 2 to 3 per cent.; nitrogen, 2.5 to 3.25 per cent. (equivalent to ammonia, 3 to 4 per cent.).

	Per cent.
Moisture at 100° C.,	12.78
Total phosphoric acid,	11.60
Soluble phosphoric acid,	6.52
Reverted phosphoric acid,	2.77
Insoluble phosphoric acid,	2.31
Potassium oxide,	1.25
Nitrogen,	2.80
Insoluble matter,	4.45

Valuation per two thousand pounds: —

130.4 pounds of soluble phosphoric acid,	$10 43
55.4 pounds of reverted phosphoric acid,	4 16
46.2 pounds of insoluble phosphoric acid,	1 39
25. pounds of potassium oxide,	1 38
56. pounds of nitrogen,	9 52
	$26 88

Church's Fish and Potash.

(Collected of Earle & Peckham, Worcester, Mass)

Guaranteed composition: Total phosphoric acid, 5.32 per cent.; potassium oxide, 3.58 per cent.; ammonia, 5.08 per cent. (equivalent to nitrogen, 4.18 per cent.).

	Per cent.
Moisture at 100° C.,	29 80
Total phosphoric acid,	3.62
Soluble phosphoric acid,	86
Reverted phosphoric acid,	2 14
Insoluble phosphoric acid,	.62
Potassium oxide,	4 27
Nitrogen,	3.76
Insoluble matter,	1.35

Valuation per two thousand pounds: —

17.2 pounds of soluble phosphoric acid,	$1 38
42.8 pounds of reverted phosphoric acid,	3 21
12 4 pounds of insoluble phosphoric acid,	37
85 4 pounds of potassium oxide,	3 63
72.5 pounds of nitrogen,	12 78
	$21 37

Stockbridge's Manure (Seeding down).

(Collected of Earle & Peckham, Worcester, Mass.)

Guaranteed composition: Soluble phosphoric acid, 2.5 to 3 per cent.; available phosphoric acid, 14 to 15 per cent.; potassium oxide, 4 to 5 per cent.; ammonia, 3 to 4 per cent. (equivalent to nitrogen, 2.5 to 3.3 per cent.).

	Per cent.
Moisture at 100° C.,	14 88
Total phosphoric acid,	12 70
Soluble phosphoric acid,	7 42
Reverted phosphorie acid,	3.51
Insoluble phosphoric acid,	1.77
Potassium oxide,	2 53
Nitrogen,	2.77
Insoluble matter,	3.68

Valuation per two thousand pounds: —

148.4 pounds of soluble phosphoric acid,	$11 87
70.2 pounds of reverted phosphoric acid,	5 27
35.4 pounds of insoluble phosphoric acid,	1 06
50.6 pounds of potassium oxide,	2 15
55.4 pounds of nitrogen,	9 42
	$29 77

Jefferd's Animal Fertilizer, with Potash.

(Collected of Earle & Peckham, Worcester, Mass.)

Guaranteed composition: Total phosphoric acid, 14 to 15 per cent.); potassium oxide, 3½ to 4 per cent.; ammonia, 5 to 5½ per cent. (equivalent to nitrogen, 4.1 to 4.5 per cent.).

	Per cent.
Moisture at 100° C.,	9 58
Total phosphoric acid,	15.46
Soluble phosphoric acid,	.13
Reverted phosphoric acid,	5 22
Insoluble phosphoric acid,	10.53
Potassium oxide,	4.82
Nitrogen,	4.28
Insoluble matter,	.56

Valuation per two thousand pounds: —

2.6	pounds of soluble phosphoric acid,	$0 21
104.4	pounds of reverted phosphoric acid,	7 83
210 6	pounds of insoluble phosphoric acid,	8 42
96.4	pounds of potassium oxide,	4 10
85.6	pounds of nitrogen,	14 55
		$35 11

Bowker's Fish and Potash.

(Collected of Earle & Peckham, Worcester, Mass.)

Guaranteed composition: Total phosphoric acid, 8 to 10 per cent.; potassium oxide, 4 to 6 per cent.; nitrogen, 2 to 3 per cent. (equivalent to ammonia, 3 to 4 per cent.).

	Per cent.
Moisture at 100° C.,	10.20
Total phosphoric acid,	10.86
Soluble phosphoric acid,	4 00
Reverted phosphoric acid,	3.91
Insoluble phosphoric acid,	2.95
Potassium oxide,	3.68
Nitrogen,	3.83
Insoluble matter,	5.10

Valuation per two thousand pounds: —

80.	pounds of soluble phosphoric acid,	$6 40
78.2	pounds of reverted phosphoric acid,	5 87
59.	pounds of insoluble phosphoric acid,	1 77
73 6	pounds of potassium oxide,	3 13
76.6	pounds of nitrogen,	13 02
		$30 19

Mape's Corn Manure.

(Collected of Earle & Peckham, Worcester, Mass.)

Guaranteed composition: Total phosphoric acid, 10 to 12 per cent.; potassium oxide, 6 to 7 per cent.; nitrogen, 3.7 to 4.1 per cent. (equivalent to ammonia, 4½ to 5 per cent.).

	Per cent.
Moisture at 100° C.,	14.06
Total phosphoric acid,	13.99
Soluble phosphoric acid,	8.89
Reverted phosphoric acid,	2.66
Insoluble phosphoric acid,	2.44
Potassium oxide,	4.76
Nitrogen (in ammonia salts),	1.18
Nitrogen (in nitrates),	.82
Nitrogen (in organic matter),	1.60
Insoluble matter,	.68

Valuation per two thousand pounds:—

177.8 pounds of soluble phosphoric acid,	$14 22
53.2 pounds of reverted phosphoric acid,	3 99
48.8 pounds of insoluble phosphoric acid,	1 46
95.2 pounds of potassium oxide,	4 05
23.6 pounds of nitrogen (in ammonia salts),	4 37
16.4 pounds of nitrogen (in nitrates),	3 03
32. pounds of nitrogen (in organic matter),	5 44
	$36 56

Mape's Complete Manure.

(Collected of Earle & Peckham, Worcester, Mass.)

Guaranteed composition: Total phosphoric acid, 10 to 12 per cent.; potassium oxide, 4 to 5 per cent.; nitrogen, 3.3 to 4.1 per cent. (equivalent to ammonia, 4 to 5 per cent.).

	Per cent.
Moisture at 100° C.,	13 16
Total phosphoric acid,	12.24
Soluble phosphoric acid,	5.69
Reverted phosphoric acid,	2.83
Insoluble phosphoric acid,	3.72
Potassium oxide,	4.06
Nitrogen (in ammonia salts),	1.00
Nitrogen (in nitrates),	1.04
Nitrogen (in organic matter),	1.12
Insoluble matter,	.56

Valuation per two thousand pounds:—

113.8 pounds of soluble phosphoric acid,	$9 10
76.6 pounds of reverted phosphoric acid,	5 75
74.4 pounds of insoluble phosphoric acid,	2 23
81.2 pounds of potassium oxide,	3 45
22.4 pounds of nitrogen (in organic matter),	3 81
20.8 pounds of nitrogen (in nitrates),	3 85
20. pounds of nitrogen (in ammonia salts),	3 70
	$31 89

C. W. Belknap & Son's Pure Ground Bone Fertilizer.

(Collected of J. & J. A. Rice, Worcester, Mass.)

Guaranteed composition: Total phosphoric acid, 24 to 38 per cent.; ammonia, 3.35 to 4.41 per cent. (equivalent to nitrogen, 2.8 to 3.63 per cent.).

	Per cent.
Moisture at 100° C.,	10 56
Total phosphoric acid,	23.15
Soluble phosphoric acid,	none.
Reverted phosphoric acid,	6.32
Insoluble phosphoric acid,	16.83
Nitrogen,	3.47
Insoluble matter,	.24

Valuation per two thousand pounds:—

126.4 pounds of reverted phosphoric acid,	$9 48
336.6 pounds of insoluble phosphoric acid,	13 46
69.4 pounds of nitrogen,	9 72
	$32 66

Bosworth Brothers' Superphosphate of Lime.

(Collected of Wilson & Holden, Worcester, Mass.)

Guaranteed composition: Soluble phosphoric acid, 7 to 8 per cent.; reverted phosphoric acid, 4 to 5 per cent.; insoluble phosphoric acid, 2 to 5 per cent.; potassium oxide, 2 to 3 per cent.; nitrogen, 2 to 2½ per cent.

	Per cent.
Moisture at 100° C.,	8.90
Total phosphoric acid,	14.76
Soluble phosphoric acid,	5.25
Reverted phosphoric acid,	4.69
Insoluble phosphoric acid,	4.82
Potassium oxide,	1 61
Nitrogen,	2 54
Insoluble matter,	.85

Valuation per two thousand pounds:—

105. pounds of soluble phosphoric acid,	$8 40
93.8 pounds of reverted phosphoric acid,	7 04
96.4 pounds of insoluble phosphoric acid,	2 89
32.2 pounds of potassium oxide,	1 37
50.8 pounds of nitrogen,	8 64
	$28 34

Pure Ground Bones.

(Warren Glover, North Grafton, Mass.; collected of J. & J. A. Rice, Worcester, Mass.)

	Per cent.
Moisture at 100° C.,	7.95
Total phosphoric acid,	21.47
Soluble phosphoric acid,	none.
Reverted phosphoric acid,	6.23
Insoluble phosphoric acid,	15.24
Nitrogen,	4.20
Insoluble matter,	1.53

Valuation per two thousand pounds:—

124.6 pounds of reverted phosphoric acid,	$9 35
304.8 pounds of insoluble phosphoric acid,	12 19
84. pounds of nitrogen,	11 76
	$33 30

Lawn Dressing.

(Manufactured by L. B. Darling Fertilizer Company, for Earle & Peckham, Worcester, Mass.; collected of Earle & Peckham, Worcester, Mass.)

Guaranteed composition: Total phosphoric acid, 6 to 8 per cent.; available phosphoric acid, 5 to 7 per cent.; potassium oxide, 4 to 5 per cent.; ammonia, 4 to 5 per cent. (equivalent to nitrogen, 3.3 to 4.1 per cent.).

	Per cent.
Moisture at 100° C.,	10.67
Total phosphoric acid,	8.27
Soluble phosphoric acid,	3.40
Reverted phosphoric acid,	2.76
Insoluble phosphoric acid,	2.06
Potassium oxide,	3.37
Nitrogen,	4.03
Insoluble matter,	1.52

Valuation per two thousand pounds:—

68. pounds of soluble phosphoric acid,	$5 44
55.2 pounds of reverted phosphoric acid,	4 14
41.2 pounds of insoluble phosphoric acid,	1 24
67.4 pounds of potassium oxide,	2 86
80.6 pounds of nitrogen,	13 70
	$27 38

C. A. Bartlett's Ground Bones.

(Collected of C. A. Bartlett, Worcester, Mass.)

	Per cent.
Moisture at 100° C.,	6.18
Total phosphoric acid,	27.35
Soluble phosphoric acid,	.48
Reverted phosphoric acid,	7.11
Insoluble phosphoric acid,	19.76
Nitrogen,	2.39
Insoluble matter,	.23

Valuation per two thousand pounds: —

9.6 pounds of soluble phosphoric acid,	$0 77
142.2 pounds of reverted phosphoric acid,	10 67
395.2 pounds of insoluble phosphoric acid,	19 76
47.8 pounds of nitrogen,	7 17
	$38 37

Randall's Field and Farm.

(Collected of J. J. Stanley, Lawrence, Mass.)

Guaranteed composition: Total phosphoric acid, 10 to 14 per cent.; available phosphoric acid, 8 to 10 per cent.; potassium oxide, 2 to 3 per cent.; ammonia, 2½ to 3½ per cent. (equivalent to nitrogen, 2 to 2.9 per cent.).

	Per cent.
Moisture at 100° C.,	16.43
Total phosphoric acid,	7.84
Soluble phosphoric acid,	4.73
Reverted phosphoric acid,	1.65
Insoluble phosphoric acid,	1.46
Potassium oxide,	2.16
Nitrogen,	1.85
Insoluble matter,	2.58

Valuation per two thousand pounds: —

94.6 pounds of soluble phosphoric acid,	$7 57
33. pounds of reverted phosphoric acid,	2 48
29.2 pounds of insoluble phosphoric acid,	88
43.2 pounds of potassium oxide,	1 84
37. pounds of nitrogen,	6 29
	$19 06

Sparrow's B. B. Superphosphates.

(Collected of G. W. Atkinson, Reading, Mass.)

Guaranteed composition: Total phosphoric acid, 10 to 12 per cent.; available phosphoric acid, 8 to 10 per cent.; potassium oxide, 2 to 3 per cent.; nitrogen, 2.06 to 2.88 per cent. (equivalent to ammonia, 2½ to 3½ per cent.).

	Per cent.
Moisture at 100° C.,	21.10
Total phosphoric acid,	11.42
Soluble phosphoric acid,	7.89
Reverted phosphoric acid,	2.82
Insoluble phosphoric acid,	.71
Potassium oxide,	1.92
Nitrogen (in organic matter),	1.32
Nitrogen (in nitrates),	.26
Nitrogen (in ammonia salts),	1.17
Insoluble matter,	3.38

Valuation per two thousand pounds: —

157.8 pounds of soluble phosphoric acid,	$12 62
56.4 pounds of reverted phosphoric acid,	4 23
14.2 pounds of insoluble phosphoric acid,	43
38.4 pounds of potassium oxide,	1 63
26.4 pounds of nitrogen (in organic matter),	4 49
5.2 pounds of nitrogen (in nitrates),	96
23.4 pounds of nitrogen (in ammonia salts),	4 33
	$28 69

Lowell Bone Fertilizer.

(Manufactured by J. M. Butman, Lowell, Mass.; collected of J. M. Butman, Lowell, Mass.)

Guaranteed composition: Total phosphoric acid, 10 to 18 per cent.; soluble phosphoric acid, 6 to 10 per cent.; potassium oxide, 2 to 5 per cent.; nitrogen, 2¼ to 4 per cent.

	Per cent.
Moisture at 100° C.,	17.35
Total phosphoric acid,	12.80
Soluble phosphoric acid,	6.49
Reverted phosphoric acid,	4.93
Insoluble phosphoric acid,	1.38
Potassium oxide,	2.34
Nitrogen,	2.71
Insoluble matter,	1.15

Valuation per two thousand pounds: —

129.8 pounds of soluble phosphoric acid,	$10 38
98.6 pounds of reverted phosphoric acid,	7 40
27.6 pounds of insoluble phosphoric acid,	83
46.8 pounds of potassium oxide,	1 99
54.2 pounds of nitrogen,	9 21
	$29 81

Sparrow's Grass Fertilizer.

(Collected of G. W. Atkinson, Reading, Mass.)

Guaranteed composition: Total phosphoric acid, 8 to 10 per cent.; soluble and reverted phosphoric acid, 4 to 6 per cent.; potassium oxide, 4 to 5 per cent.; nitrogen, 4.11 to 4.94 per cent.

	Per cent.
Moisture at 100° C.,	12.38
Total phosphoric acid,	11.84
Soluble phosphoric acid,	2.43
Reverted phosphoric acid,	4.18
Insoluble phosphoric acid,	5.23
Potassium oxide,	4.53
Nitrogen (in ammonia salts),	1.21
Nitrogen (in nitrates),	.94
Nitrogen (in organic matter),	1.96
Insoluble matter,	1.00

Valuation per two thousand pounds: —

48.6 pounds of soluble phosphoric acid,	$3 89
83.6 pounds of reverted phosphoric acid,	6 27
104.6 pounds of insoluble phosphoric acid,	3 14
90.6 pounds of potassium oxide,	3 85
24 2 pounds of nitrogen (in ammonia salts),	4 48
18.8 pounds of nitrogen (in nitrates),	3 48
39.2 pounds of nitrogen (in organic matter),	6 66
	$31 77

Maynard's Perfect Mineral Fertilizer.

(Collected of C. A. Maynard, Lawrence, Mass.)

Guaranteed composition: Moisture, 19.4 per cent.; chlorine, 7.69 per cent.; sulphuric acid, 2.61 per cent.; carbonic acid, 22.25 per cent.; total phosphoric acid, 1.37 per cent.; calcium oxide, 33.39 per cent.; sodium oxide, 7.55 per cent.; potassium oxide, .44 per cent.; ferric oxide, 1.03 per cent.; insoluble matter, 5.15 per cent.; soluble and available phosphoric acid, 8 to 10 per cent.

	Per cent.
Moisture at 100° C.,	23.05
Total phosphoric acid,	.76
Soluble phosphoric acid,	trace.
Insoluble phosphoric acid,	.74
Potassium oxide,	.83
Magnesium oxide,	1.71
Calcium oxide,	36.39
Sodium oxide,	8.35

	Per cent.
Chlorine,	9.25
Sulphuric acid,	5.32
Insoluble matter,	23.55

This fertilizer is evidently a mixture of wood ashes, gypsum, salt and lime compounds; one sample was very deficient in available phosphoric acid. It ought to sell at the cost of ordinary wood ashes.

Flamingo Guano.

(Flamingo Guano Company, Liebig & Gibbons, General Agents, Baltimore, Md.; collected of J. B. Cover & Co., Lowell, Mass.)

Guaranteed composition: Soluble and reverted phosphoric acid, 10 to 14 per cent.; insoluble phosphoric acid, 3 to 5 per cent.; potassium oxide, .25 to .75 per cent.; nitrogen, 1.03 per cent. (equivalent to ammonia, 1.25 per cent.).

	Per cent.
Moisture at 100° C.,	36.85
Total phosphoric acid,	12.99
Soluble phosphoric acid,	.13
Reverted phosphoric acid,	6.61
Insoluble phosphoric acid,	6.25
Potassium oxide,	.32
Nitrogen,	.63
Insoluble matter,	3.40

Valuation per two thousand pounds:—

2.6	pounds of soluble phosphoric acid,	$0 21
132.2	pounds of reverted phosphoric acid,	9 92
125.	pounds of insoluble phosphoric acid,	3 75
6.40	pounds of potassium oxide,	27
12.60	pounds of nitrogen,	2 14
		$16 29

Dole's Common Sense Fertilizer.

(Common Sense Fertilizer Company; collected of C. W. Howard, Lawrence, Mass.)

Guaranteed composition: Total phosphoric acid, 4 to 6 per cent.; potassium oxide, 3 to 5 per cent.; nitrogen, 2 to 5 per cent.

	Per cent.
Moisture at 100° C.,	12.80
Total phosphoric acid,	5.21
Soluble phosphoric acid,	.13
Reverted phosphoric acid,	3.03
Insoluble phosphoric acid,	2.05
Potassium oxide,	4.45
Nitrogen,	2 26
Insoluble matter,	22 68

Valuation per two thousand pounds: —

2.6	pounds of soluble phosphoric acid,	$0 21
60.6	pounds of reverted phosphoric acid,	4 55
41.	pounds of insoluble phosphoric acid,	1 23
89.	pounds of potassium oxide,	3 78
45.2	pounds of nitrogen,	7 68
		$17 45

Dow's Nitrogenous Superphosphate.

(Collected of J. Stackpole & Sons, Ipswich, Mass.)

Guaranteed composition: Available phosphoric acid, 8 to 10 per cent.; muriate of potash, 3 to 4 per cent.; ammonia, 2½ to 3½ per cent. (equivalent to nitrogen, 2 to 2.9 per cent.).

	Per cent.
Moisture at 100° C.,	18.42
Total phosphoric acid,	9.97
Soluble phosphoric acid,	6.40
Reverted phosphoric acid,	2.84
Insoluble phosphoric acid,	.73
Potassium oxide,	3.36
Nitrogen,	2.70
Insoluble matter,	.88

Valuation per two thousand pounds: —

128.	pounds of soluble phosphoric acid,	$10 24
56.8	pounds of reverted phosphoric acid,	4 26
14.6	pounds of insoluble phosphoric acid,	44
67.2	pounds of potassium oxide,	2 86
54.	pounds of nitrogen,	9 18
		$26 98

Darling's Animal Fertilizer.

(Collected of W. E. Livingston, Lowell, Mass.)

Guaranteed composition: Total phosphoric acid, 10 to 12 per cent.; potassium oxide, 4 to 6 per cent.; ammonia, 4 to 6 per cent. (equivalent to nitrogen, 3.3 to 5 per cent.).

	Per cent.
Moisture at 100° C.,	12.54
Total phosphoric acid,	12.49
Soluble phosphoric acid,	2.49
Reverted phosphoric acid,	5.32
Insoluble phosphoric acid,	4.68
Potassium oxide,	4.45
Nitrogen,	3.40
Insoluble matter,	1.02

Valuation per two thousand pounds: —

49.80 pounds of soluble phosphoric acid,	$3 98
106.4 pounds of reverted phosphoric acid,	7 98
93.6 pounds of insoluble phosphoric acid,	1 91
89. pounds of potassium oxide,	3 78
68. pounds of nitrogen,	11 56
	$29 21

Pure Raw Bone Fertilizer.

(A. L. Ames, Peabody, Mass.; collected at Danvers Asylum, Danvers, Mass.)

Guaranteed composition: Available phosphoric acid, 8 to 11 per cent.; ammonia, 2½ to 3½ per cent. (equivalent to nitrogen, 2 to 2.9 per cent.); potassium chloride, 4 to 6 per cent.

	Per cent.
Moisture at 100° C.,	16.58
Total phosphoric acid,	13.82
Soluble phosphoric acid,	3.65
Reverted phosphoric acid,	8.70
Insoluble phosphoric acid,	1.47
Potassium oxide,	2.28
Nitrogen,	3.07
Insoluble matter,	.75

Valuation per two thousand pounds: —

73. pounds of soluble phosphoric acid,	$5 84
174. pounds of reverted phosphoric acid,	13 05
29.4 pounds of insoluble phosphoric acid,	88
45.6 pounds of potassium oxide,	1 94
61.4 pounds of nitrogen,	10 44
	$32 15

Bowker's Hill and Drill Phosphate.

(Collected of Scott & Vietor, Lowell, Mass.)

Guaranteed composition: Total phosphoric acid, 11 to 13 per cent.; soluble phosphoric acid, 8 to 10 per cent.; reverted phosphoric acid, 1 to 2 per cent.; potassium sulphate, 2 to 3 per cent.; nitrogen, 2.5 to 3.5 per cent. (equivalent to ammonia, 3 to 4 per cent.).

	Per cent.
Moisture at 100° C.,	16.05
Total phosphoric acid,	11.91
Soluble phosphoric acid,	7.20
Reverted phosphoric acid,	2.60
Insoluble phosphoric acid,	2.11
Potassium oxide,	1.12
Nitrogen,	2.54
Insoluble matter,	3.18

Valuation per two thousand pounds: —

144. pounds of soluble phosphoric acid,	$11 52
52. pounds of reverted phosphoric acid,	3 90
42.2 pounds of insoluble phosphoric acid,	1 27
22.4 pounds of potassium oxide,	1 23
50.8 pounds of nitrogen,	8 64
	$26 56

Lee, Blackburn & Co.'s Potato Fertilizer.

(Collected of Scott & Victor, Lawrence, Mass.)

Guaranteed composition: Total phosphoric acid, 8 to 10 per cent.; potassium oxide, 6 to 7 per cent.; ammonia, 4 to 5 per cent. (equivalent to nitrogen, 3.3 to 4.1 per cent.)

	Per cent.
Moisture at 100° C,	19.80
Total phosphoric acid,	12.55
Soluble phosphoric acid,	10.81
Reverted phosphoric acid,	1.52
Insoluble phosphoric acid,	.22
Potassium oxide,	3.05
Nitrogen,	2.63
Insoluble matter,	.83

Valuation per two thousand pounds: —

216.2 pounds of soluble phosphoric acid,	$17 30
30.4 pounds of reverted phosphoric acid,	2 28
4.4 pounds of insoluble phosphoric acid,	13
61. pounds of potassium oxide,	2 59
52.6 pounds of nitrogen,	8 94
	$31 24

Lawrence Fertilizer.

(Lee, Blackburn & Co., Lawrence, Mass.; collected of Scott & Vietor, Lawrence, Mass.)

Guaranteed composition: Total phosphoric acid, 12 to 14 per cent.; potassium oxide, 2 to 3 per cent.; nitrogen, 2 to 3 per cent. (equivalent to ammonia, 3 to 4 per cent.).

	Per cent.
Moisture at 100° C.,	18.20
Total phosphoric acid,	13.61
Soluble phosphoric acid,	11.58
Reverted phosphoric acid,	1.87
Insoluble phosphoric acid,	.16
Potassium oxide,	2.32
Nitrogen,	2.46
Insoluble matter,	1.30

Valuation per two thousand pounds: —

231.6 pounds of soluble phosphoric acid,	$18 53
37.4 pounds of reverted phosphoric acid,	2 81
3.2 pounds of insoluble phosphoric acid,	10
46.4 pounds of potassium oxide,	1 97
49 2 pounds of nitrogen,	8 36
	$31 77

Darling's Ground Bone.

(Collected of C. N. Pearsey, Danvers, Mass.)

Guaranteed composition: Total phosphoric acid, 22 to 25 per cent.; bone phosphate, 52 to 55 per cent.; nitrogen, 3.5 to 4.5 per cent. (equivalent to ammonia, 4 to 5 per cent.).

	Per cent.
Moisture at 100° C.,	7.42
Total phosphoric acid,	24.65
Soluble phosphoric acid,	.48
Reverted phosphoric acid,	8.53
Insoluble phosphoric acid,	15.64
Nitrogen,	3.23
Insoluble matter,	.70

Valuation per two thousand pounds: —

9.6 pounds of soluble phosphoric acid,	$0 77
170.6 pounds of reverted phosphoric acid,	12 80
312.8 pounds of insoluble phosphoric acid,	15 64
64.6 pounds of nitrogen,	9 69
	$38 90

Lee, Blackburn & Co.'s Ground Bones.

(Collected of Lee, Blackburn & Co., Lawrence, Mass.)

No guaranty stated.

	Per cent.
Moisture at 100° C.,	9.37
Total phosphoric acid,	22.19
Soluble phosphoric acid,	none.
Reverted phosphoric acid,	4.10
Insoluble phosphoric acid,	18.09
Nitrogen,	2.10
Insoluble matter,	1.96

Valuation per two thousand pounds: —

82. pounds of reverted phosphoric acid,	$6 15
361.8 pounds of insoluble phosphoric acid,	18 09
42. pounds of nitrogen,	6 30
	$30 54

Riverside Fertilizer.

(Manufactured by J. O. Whitten, Boston, Mass.; collected of J. S. Stackpole & Sons, Ipswich, Mass.)

Guaranteed composition: Moisture, 3.03 per cent.; total phosphoric acid, 22.99 per cent.; soluble phosphoric acid, 1.28 per cent.; reverted phosphoric acid, 10.60 per cent.; insoluble phosphoric acid, 11.11 per cent.; nitrogen, 2.87 per cent. (equivalent to ammonia, 3.48 per cent.).

	Per cent.
Moisture at 100° C.,	11 11
Total phosphoric acid,	20.57
Soluble phosphoric acid,	.72
Reverted phosphoric acid,	6 93
Insoluble phosphoric acid,	12.92
Nitrogen,	2.91
Insoluble matter,	1.40

Valuation per two thousand pounds: —

14.4 pounds of soluble phosphoric acid,	$1 15
138.6 pounds of reverted phosphoric acid,	10 40
258.4 pounds of insoluble phosphoric acid,	10 34
58.2 pounds of nitrogen,	8 73
	$30 62

Stockbridge's Manure Roots.

(Collected of E. W. Wood & Co., Lowell, Mass.)

Guaranteed composition: Available phosphoric acid, 9 to 11 per cent.; nitrogen, 2½ to 3¼ per cent. (equivalent to ammonia, 3 to 4 per cent.); potassium oxide, 2 to 4 per cent.

	Per cent.
Moisture at 100° C.,	14.85
Total phosphoric acid,	9.41
Soluble phosphoric acid,	6.49
Reverted phosphoric acid,	2.20
Insoluble phosphoric acid,	.72
Potassium oxide,	5.81
Nitrogen,	3.90
Insoluble matter,	2.96

Valuation per two thousand pounds: —

129.8 pounds of soluble phosphoric acid,	$10 38
44. pounds of reverted phosphoric acid,	3 30
14.4 pounds of insoluble phosphoric acid,	43
116.2 pounds of potassium oxide,	4 95
78. pounds of nitrogen,	13 26
	$32 32

Lee, Blackburn & Co.'s Ground Bone.

(Collected of Scott & Vietor, Lawrence, Mass.)

No guaranty stated.

	Per cent.
Moisture at 100° C.,	11.90
Total phosphoric acid,	22.22
Soluble phosphoric acid,	none.
Reverted phosphoric acid,	8.01
Insoluble phosphoric acid,	14.21
Nitrogen,	2.45
Insoluble matter,	.90

Valuation per two thousand pounds: —

160.2 pounds of soluble phosphoric acid,	$12 02
284.2 pounds of insoluble phosphoric acid,	14 21
49. pounds of nitrogen,	7 35
	$33 58

George W. Miles' Fish and Potash.

(Collected of B. F. Bridges, Jr., South Deerfield, Mass.)

Guaranteed composition: Available phosphoric acid, 5 to 8 per cent.; insoluble phosphoric acid, 1 to 3 per cent.; potassium sulphate, 4 to 6 per cent.; ammonia, 3 to 6 per cent. (equivalent to nitrogen, 2.5 to 5 per cent.).

	Per cent.
Moisture at 100° C.,	14.75
Total phosphoric acid,	10.75
Soluble phosphoric acid,	6.08
Reverted phosphoric acid,	2.70
Insoluble phosphoric acid,	1.97
Potassium oxide,	3.08
Nitrogen,	2.32
Insoluble matter,	5.88

Valuation per two thousand pounds: —

121.6 pounds of soluble phosphoric acid,	$9 73
54. pounds of reverted phosphoric acid,	4 05
39.4 pounds of insoluble phosphoric acid,	1 18
61.6 pounds of potassium oxide,	3 39
46.4 pounds of nitrogen,	7 89
	$26 24

B. F. Bridges, Jr., "Fish Fertilizer."

(Collected of B. F. Bridges, Jr., South Deerfield, Mass.)

Guaranteed composition: Total phosphoric acid, 3 to 4 per cent.; nitrogen, 2¾ to 4 per cent.; potassium oxide, 3 to 4 per cent.

	Per cent.
Moisture at 100° C.,	27.23
Total phosphoric acid,	3.72
Soluble phosphoric acid,	1.28
Reverted phosphoric acid,	1.96
Insoluble phosphoric acid,	.48
Potassium oxide,	2.49
Nitrogen,	4.23
Insoluble matter,	4.44

Valuation per two thousand pounds:—

25.6 pounds of soluble phosphoric acid,	$2 05
39.2 pounds of reverted phosphoric acid,	2 94
9.6 pounds of insoluble phosphoric acid,	29
49.8 pounds of potassium oxide,	2 12
84.6 pounds of nitrogen,	14 38
	$21 78

George W. Miles' IXL Ammoniated Bone Superphosphate.

(Collected of B. F. Bridges, Jr., South Deerfield, Mass.)

Guaranteed composition: Available phosphoric acid, 8 to 12 per cent.; insoluble phosphoric acid, 1 to 3 per cent.; potassium sulphate, 1 to 3 per cent.; ammonia, 2½ to 4 per cent. (equivalent to nitrogen, 2 to 3.3 per cent.).

	Per cent.
Moisture at 100° C.,	17.80
Total phosphoric acid,	11.91
Soluble phosphoric acid,	6.46
Reverted phosphoric acid,	4.28
Insoluble phosphoric acid,	1.17
Potassium oxide,	.98
Nitrogen,	2.21
Insoluble matter,	5.98

Valuation per two thousand pounds:—

129.2 pounds of soluble phosphoric acid,	$10 34
85.6 pounds of reverted phosphoric acid,	6 42
23.4 pounds of insoluble phosphoric acid,	70
19.6 pounds of potassium oxide,	1 08
44.2 pounds of nitrogen,	7 51
	$26 05

Dole's Fertilizer 203.

(Collected of B. F. Bridges, Jr., South Deerfield, Mass.)

Guaranteed composition: Total phosphoric acid, 10 to 12 per cent.; soluble and reverted phosphoric acid, 3 to 10 per cent.; potassium sulphate, 3 to 4 per cent.; nitrogen, 3 to 4 per cent. (equivalent to ammonia, 3½ to 4½ per cent.).

	Per cent.
Moisture at 100° C.,	12.10
Total phosphoric acid,	13 66
Soluble phosphoric acid,	8.12
Reverted phosphoric acid,	1.62
Insoluble phosphoric acid,	3.92
Potassium oxide,	4.06
Nitrogen,	1.64
Insoluble matter,	4.68

Valuation per two thousand pounds : —

162.4 pounds of soluble phosphoric acid,	$12 99
32.4 pounds of reverted phosphoric acid,	2 43
78 4 pounds of insoluble phosphoric acid,	2 35
81.2 pounds of potassium oxide,	4 47
32.8 pounds of nitrogen,	5 58
	$27 82

Brightman & Co.'s Ammoniated Bone Superphosphate.

(Collected of Pease & Easterbrook, Fall River, Mass.)

Guaranteed composition : Total phosphoric acid, 10 to 11 per cent. ; soluble phosphoric acid, 8 to 10 per cent. ; potassium oxide, 3 to 5 per cent. ; ammonia, 3 to 5 per cent. (equivalent to nitrogen, 2.5 to 4.1 per cent.).

	Per cent.
Moisture at 100° C.,	21.22
Total phosphoric acid,	8.33
Soluble phosphoric acid,	5 25
Reverted phosphoric acid,	1.51
Insoluble phosphoric acid,	1.57
Potassium oxide,	2.57
Nitrogen,	2.95
Insoluble matter,	8.50

Valuation per two thousand pounds : —

105. pounds of soluble phosphoric acid,	$8 40
30.2 pounds of reverted phosphoric acid,	2 27
31.4 pounds of insoluble phosphoric acid,	94
51.4 pounds of potassium oxide,	2 19
59. pounds of nitrogen,	10 03
	$23 83

Soluble Pacific Guano Company's Fish & Potash

(Collected of H. D. Mantor & Co., Plymouth, Mass.)

Guaranteed composition : Total phosphoric acid, 6 to 9 per cent. ; soluble phosphoric acid, 3 to 5 per cent. ; reverted phosphoric acid, 1 to 2 per cent.; insoluble phosphoric acid, 4 to 7 per cent.; ammonia, 3 to 4 per cent. (equivalent to nitrogen, 2.5 to 3.3 per cent.).

	Per cent.
Moisture at 100° C.,	16.13
Total phosphoric acid,	8.91
Soluble phosphoric acid,	5.44
Reverted phosphoric acid,	1.76
Insoluble phosphoric acid,	1.71
Potassium oxide,	4.10
Nitrogen,	2.80
Insoluble matter,	4.03

Valuation per two thousand pounds: —

108.8 pounds of soluble phosphoric acid,	$8 70
35.2 pounds of reverted phosphoric acid,	2 64
34.2 pounds of insoluble phosphoric acid,	1 03
82. pounds of potassium oxide,	3 49
56. pounds of nitrogen,	9 52
	$25 38

Charles H. North's Animal Fertilizer.

(Collected of Charles H. North, Somerville, Mass.)

No guaranty given.

	Per cent.
Moisture at 100° C.,	11.06
Total phosphoric acid,	10 54
Soluble phosphoric acid,	none.
Reverted phosphoric acid,	3.88
Insoluble phosphoric acid,	6.66
Nitrogen,	6.02
Insoluble matter,	.52

Valuation per two thousand pounds: —

77.6 pounds of reverted phosphoric acid,	$5 82
133.2 pounds of insoluble phosphoric acid,	4 00
120 4 pounds of nitrogen,	20 47
	$30 29

Soluble Pacific Guano.

(Collected of Pease & Easterbrook, Fall River, Mass.)

Guaranteed composition: Moisture, 15 to 18 per cent.; total phosphoric acid, 12 to 14 per cent.; soluble phosphoric acid, 6½ to 8 per cent.; reverted phosphoric acid, 1½ to 3 per cent.; insoluble phosphoric acid, 2 to 4 per cent.; potassium oxide, 2 to 3 per cent.; nitrogen, 2 to 3 per cent. (equivalent to ammonia, 2½ to 3½ per cent.).

	Per cent.
Moisture at 100° C.,	12.38
Total phosphoric acid,	12.77
Soluble phosphoric acid,	7.20
Reverted phosphoric acid,	1.86
Insoluble phosphoric acid,	3.71
Potassium oxide,	2.33
Nitrogen,	2.66
Insoluble matter,	5.82

Valuation per two thousand pounds:—

144. pounds of soluble phosphoric acid,	$11 52
37.2 pounds of reverted phosphoric acid,	2 79
74.2 pounds of insoluble phosphoric acid,	2 23
46.6 pounds of potassium oxide,	1 98
53.2 pounds of nitrogen,	9 04
	$27 56

Bay State Fertilizer.

(Clark's Cove Guano Company, New Bedford, Mass.; collected of J. R. Atwood, Plymouth, Mass.)

Guaranteed composition: Total phosphoric acid, 10 to 13 per cent.; soluble phosphoric acid, 6 to 9 per cent.; reverted phosphoric acid, 2 to 2½ per cent.; available phosphoric acid, 8 to 11 per cent.; potassium oxide, 2 to 3½ per cent.; nitrogen, 2.1 to 2.8 per cent. (equivalent to ammonia, 2.55 to 3.5 per cent.).

	Per cent.
Moisture at 100° C.,	15.00
Total phosphoric acid,	13.00
Soluble phosphoric acid,	10.11
Reverted phosphoric acid,	1.76
Insoluble phosphoric acid,	1.13
Potassium oxide,	1.98
Nitrogen,	2.50
Insoluble matter,	5.25

Valuation per two thousand pounds:—

202.2 pounds of soluble phosphoric acid,	$16 18
35.2 pounds of reverted phosphoric acid,	2 64
22.6 pounds of insoluble phosphoric acid,	68
39.6 pounds of potassium oxide,	1 68
50. pounds of nitrogen,	8 50
	$29 68

Church's Standard Fertilizer.

(Collected of Globe Coal Company, Fall River, Mass.)

Guaranteed composition: Total phosphoric acid, 11 to 12 per cent.; soluble phosphoric acid, 6 to 7 per cent.; reverted phosphoric acid, 1 to 2 per cent.; insoluble phosphoric acid, 3 to 4 per cent.; potassium oxide, 4 to 5 per cent.; nitrogen, 2 to 3 per cent. (equivalent to ammonia, 3 to 4 per cent.).

	Per cent.
Moisture at 100° C.,	21.56
Total phosphoric acid,	10.50
Soluble phosphoric acid,	7.36
Reverted phosphoric acid,	1.41
Insoluble phosphoric acid,	1.73
Potassium oxide,	3.54
Nitrogen,	3.33
Insoluble matter,	5.10

Valuation per two thousand pounds:—

147.2 pounds of soluble phosphoric acid,	$11 78
28.2 pounds of reverted phosphoric acid,	2 12
34.6 pounds of insoluble phosphoric acid,	1 04
70.8 pounds of potassium oxide,	3 01
66.6 pounds of nitrogen,	11 32
	$29 27

Soluble Pacific Guano.

(Collected of H. D. Mantor & Co., Plymouth, Mass.)

Guaranteed composition: Moisture 15 to 18¾ per cent.; total phosphoric acid, 12 to 14 per cent.; soluble phosphoric acid, 6½ to 8 per cent.; reverted phosphoric acid, 1½ to 3 per cent.; insoluble phosphoric acid, 2 to 4 per cent.; potassium oxide, 2 to 3 per cent.; nitrogen, 2 to 3 per cent. (equivalent to ammonia, 2½ to 3½ per cent.).

	Per cent.
Moisture at 100° C.,	20.56
Total phosphoric acid,	12.61
Soluble phosphoric acid,	8.32
Reverted phosphoric acid,	1.76
Insoluble phosphoric acid,	2.53
Potassium oxide,	1.60
Nitrogen,	2.10
Insoluble matter,	8.74

Valuation per two thousand pounds: —

166.4 pounds of soluble phosphoric acid,	$13 31
34 2 pounds of reverted phosphoric acid,	2 57
50.6 pounds of insoluble phosphoric acid,	1 52
32. pounds of potassium oxide,	1 36
42. pounds of nitrogen,	7 14
	$25 90

Sparrow's Bone and Potash Fertilizer (*B*).

(Collected of J. H. Bourne, Marshfield, Mass.)

Guaranteed composition: Total phosphoric acid, 10 to 12 per cent.; soluble and reverted phosphoric acid, 9 to 11 per cent.; potassium oxide, 4 to 5 per cent.; nitrogen, 2½ to 3.3 per cent. (equivalent to ammonia, 3 to 4 per cent.).

	Per cent.
Moisture at 100° C.,	19.75
Total phosphoric acid,	10.45
Soluble phosphoric acid,	8.32
Reverted phosphoric acid,	1.82
Insoluble phosphoric acid,	.34
Potassium oxide,	4.19
Nitrogen (in ammonia salts),	1.32
Nitrogen (in organic matter),	1.75
Insoluble matter,	1.65

Valuation per two thousand pounds: —

166.4 pounds of soluble phosphoric acid,	$13 31
36.4 pounds of reverted phosphoric acid,	2 73
6.8 pounds of insoluble phosphoric acid,	20
83.8 pounds of potassium oxide,	3 56
26.4 pounds of nitrogen (in ammonia salts),	4 88
35. pounds of nitrogen (in organic matter),	5 95
	$30 63

Brightman & Co.'s Dry Ground Menhaden Fish.

(Collected of Pease & Easterbrook, Fall River, Mass.)

Guaranteed composition: Ammonia, 10 to 12 per cent. (equivalent to nitrogen, 8.2 to 10 per cent.); bone phosphate of lime, 15 to 20 per cent.

	Per cent.
Moisture at 100° C.,	9.65
Total phosphoric acid,	8 04
Soluble phosphoric acid,	.58
Reverted phosphoric acid,	3.17
Insoluble phosphoric acid,	4.29
Nitrogen,	7.64
Insoluble matter,	2.13

Valuation per two thousand pounds: —

11.6 pounds of soluble phosphoric acid,	$0 93
63.4 pounds of reverted phosphoric acid,	4 76
85.8 pounds of insoluble phosphoric acid,	2 57
152.8 pounds of nitrogen,	25 98
	$34 24

Brightman & Co.'s Fish and Potash.

(Collected of Pease & Easterbrook, Fall River, Mass.)

Guaranteed composition: Total phosphoric acid, 5 to 6 per cent.; potassium sulphate, 3 to 5 per cent.; ammonia, 4 to 5 per cent. (equivalent to nitrogen, 3.3 to 4.1 per cent.).

	Per cent.
Moisture at 100° C,	22.68
Total phosphoric acid,	4.66
Soluble phosphoric acid,	2.17
Reverted phosphoric acid,	2.16
Insoluble phosphoric acid,	.33
Potassium oxide,	3.10
Nitrogen,	2.52
Insoluble matter,	7.52

Valuation per two thousand pounds: —

43.4 pounds of soluble phosphoric acid,	$3 47
43.2 pounds of reverted phosphoric acid,	3 24
6.6 pounds of insoluble phosphoric acid,	20
62. pounds of potassium oxide,	3 41
50.4 pounds of nitrogen,	8 57
	$18 89

Mayo's Superphosphate.

(Atlantic Fertilizer Company, Boston; collected of P. Williams & Co., Taunton, Mass.)

Guaranteed composition: Soluble phosphoric acid, 8 to 11 per cent.; available phosphoric acid, 10½ to 11½ per cent.; insoluble phosphoric acid, 1 to 2 per cent.; potassium oxide, 2.5 to 3.5 per cent.; nitrogen, 2 to 2½ per cent. (equivalent to ammonia, 2.5 to 3.5 per cent.).

	Per cent.
Moisture at 100° C.,	21.22
Total phosphoric acid,	12.86
Soluble phosphoric acid,	9.53
Reverted phosphoric acid,	1.79
Insoluble phosphoric acid,	1.54
Potassium oxide,	.85
Nitrogen,	3.43
Insoluble matter,	3.37

Valuation per two thousand pounds: —

190.6 pounds of soluble phosphoric acid,	$15 25
35.8 pounds of reverted phosphoric acid,	2 69
30.8 pounds of insoluble phosphoric acid,	92
17. pounds of potassium oxide,	72
68 6 pounds of nitrogen,	11 66
	$31 24

Stockbridge's Manures. (Corn and Grain.)

(Collected of A. B. Lawrence, Fitchburg, Mass.)

Guaranteed composition: Total phosphoric acid, 7 to 9 per cent.; available phosphoric acid, 6 to 7 per cent.; potassium oxide, 4 to 5 per cent.; nitrogen, 3¼ to 4¼ per cent. (equivalent to ammonia, 4 to 5 per cent.).

	Per cent.
Moisture at 100° C.,	12.30
Total phosphoric acid,	11 63
Soluble phosphoric acid,	7.20
Reverted phosphoric acid,	2.91
Insoluble phosphoric acid,	1.51
Potassium oxide,	3.43
Nitrogen,	4.04
Insoluble matter,	2.96

Valuation per two thousand pounds: —

144. pounds of soluble phosphoric acid.	$11 52
58.2 pounds of reverted phosphoric acid,	4 37
30.2 pounds of insoluble phosphoric acid,	91
68.6 pounds of potassium oxide,	2 92
80 8 pounds of nitrogen,	13 74
	$33 46

Mayo's Acme Superphosphate.

(Atlantic Fertilizer Company, Boston, Mass.; collected of Sprague & Williams South Framingham, Mass.)

Guaranteed composition: Soluble phosphoric acid, 9 to 11 per cent.; available phosphoric acid, 10½ to 11½ per cent.; insoluble phosphoric acid, 1 to 2 per cent.; potassium oxide, 2½ to 3½ per cent.; nitrogen. 2 to 2½ per cent. (equivalent to ammonia, 2½ to 3½ per cent.).

	Per cent.
Moisture at 100° C,	17.31
Total phosphoric acid,	13 26
Soluble phosphoric acid,	8.06
Reverted phosphoric acid,	2.51

	Per cent.
Insoluble phosphoric acid,	2.69
Potassium oxide,	1.00
Nitrogen,	2.97
Insoluble matter,	4.92

Valuation per two thousand pounds:—

161.2 pounds of soluble phosphoric acid,	$12 90
50.2 pounds of reverted phosphoric acid,	3 77
53.8 pounds of insoluble phosphoric acid,	1 61
20. pounds of potassium oxide,	85
59.4 pounds of nitrogen,	10 10
	$29 23

Cumberland Superphosphate.

(Cumberland Bone Company, Portland, Me.; collected of G. B. Knowlton, Fitchburg, Mass.)

Guaranteed composition: Moisture, 14 to 15 per cent., total phosphoric acid, 11 to 14 per cent.; soluble phosphoric acid, 5 to 7 per cent.; reverted phosphoric acid, 1 to 3 per cent.; insoluble phosphoric acid, 2 to 4 per cent.; potassium oxide, 2 to 3 per cent.; nitrogen, 2 to 3 per cent. (equivalent to ammonia, 2.41 to 3.64 per cent.).

	Per cent.
Moisture at 100° C.,	18.62
Total phosphoric acid,	12.20
Soluble phosphoric acid,	6.91
Reverted phosphoric acid	3.13
Insoluble phosphoric acid.	2.16
Potassium oxide,	2.91
Nitrogen,	2.93
Insoluble matter,	3.56

Valuation per two thousand pounds:—

138.2 pounds of soluble phosphoric acid,	$11 06
62.6 pounds of reverted phosphoric acid,	4 70
43.2 pounds of insoluble phosphoric acid,	1 30
58.2 pounds of potassium oxide,	2 47
58.6 pounds of nitrogen,	9 96
	$29 49

Spear's Perfect Fertilizer.

(Collected of Benjamin Spear & Co., Springfield, Mass.)

Guaranteed composition: Total phosphoric acid, 3.1 per cent.; potassium oxide, 2.1 per cent.: ammonia, 1.10 per cent. (equivalent to nitrogen, .8 per cent.).

	Per cent.
Moisture at 100° C.,	17.05
Total phosphoric acid,	2.55
Soluble phosphoric acid,	none.
Reverted phosphoric acid,	1.78
Insoluble phosphoric acid,	.77
Potassium oxide,	.41
Nitrogen,	1.04
Insoluble matter,	37.48

Valuation per two thousand pounds: —

35.6 pounds of reverted phosphoric acid,	$2 67
15.4 pounds of insoluble phosphoric acid,	46
8.2 pounds of potassium oxide,	35
20.8 pounds of nitrogen,	3 54
	$7 02

W. J. Brightman & Co.'s Fish and Potash.

(Collected of A. P. Slade, Somerset, Mass.)

Guaranteed composition: Total phosphoric acid, 5 to 6 per cent.; potassium sulphate, 3 to 4 per cent.; ammonia, 4 to 5 per cent. (equivalent to nitrogen, 3.3 to 4.1 per cent.).

	Per cent.
Moisture at 100° C.,	22.75
Total phosphoric acid,	5 20
Soluble phosphoric acid,	1.45
Reverted phosphoric acid,	1.81
Insoluble phosphoric acid,	1 85
Potassium oxide,	2.80
Nitrogen,	3.67
Insoluble matter,	7.30

Valuation per two thousand pounds: —

29. pounds of soluble phosphoric acid,	$2 32
36 2 pounds of reverted phosphoric acid,	2 72
37. pounds of insoluble phosphoric acid,	1 11
56. pounds of potassium oxide,	3 08
73.4 pounds of nitrogen,	12 48
	$21 71

Fish and Potash.

(Collected of W. J. Brightman & Co., Tiverton, R. I., by A. P. Slade, Somerset, Mass.)

	Per cent.
Moisture at 100° C.,	22.75
Total phosphoric acid,	5.20
Soluble phosphoric acid,	1.54
Reverted phosphoric acid,	1.81
Insoluble phosphoric acid,	1 85

	Per cent.
Potassium oxide (sulphate),	2.80
Nitrogen,	3 67
Insoluble matter,	7.30

Valuation per two thousand pounds: —

30.8 pounds of soluble phosphoric acid,	$2 46
36.2 pounds of reverted phosphoric acid,	2 72
37. pounds of insoluble phosphoric acid,	1 11
56. pounds of sulphate of potash,	3 08
73.4 pounds of nitrogen,	12 48
	$21 85

Ground Bone.

(Hargraves Manufacturing Company; collected of C. A. Lincoln, Taunton, Mass.)

	Per cent.
Moisture at 100° C.,	10.40
Total phosphoric acid,	22.39
Soluble phosphoric acid,	none.
Reverted phosphoric acid,	9.13
Insoluble phosphoric acid,	13.26
Nitrogen,	3.60
Insoluble matter,	1.73

Valuation per two thousand pounds: —

182.6 pounds of reverted phosphoric acid,	$13 70
265.2 pounds of insoluble phosphoric acid,	13 26
72. pounds of nitrogen,	10 80
	$37 76

Soluble Pacific Guano.

(Collected of H. C. Haskell, Deerfield, Mass.)

Guaranteed composition: Moisture, 15 to 18¾ per cent.; total phosphoric acid, 12 to 14 per cent.; soluble phosphoric acid, 6½ to 8 per cent.; reverted phosphoric acid, 1½ to 3 per cent.; insoluble phosphoric acid, 2 to 4 per cent.; nitrogen, 2 to 3 per cent. (equivalent to ammonia, 2½ to 3½ per cent.); potassium oxide, 2 to 3 per cent.)

	Per cent.
Moisture at 100° C.,	12.35
Total phosphoric acid,	11.95
Soluble phosphoric acid,	7.74
Reverted phosphoric acid,	1.70
Insoluble phosphoric acid,	2.51
Potassium oxide,	3.02
Nitrogen,	2.35
Insoluble matter,	5 25

Valuation per two thousand pounds:—

154.8 pounds of soluble phosphoric acid,	$12 38
34. pounds of reverted phosphoric acid,	2 55
50.2 pounds of insoluble phosphoric acid,	1 51
60.4 pounds of potassium oxide,	2 57
47. pounds of nitrogen,	7 99
	$27 00

Lister Brothers' Standard Pure Bone Superphosphate.

(Collected of W. S. Westcott, Amherst, Mass.)

Guaranteed composition: Available phosphoric acid, 10 to 12 per cent.; insoluble phosphoric acid, 2 to 9 per cent.; ammonia, 2.85 to 3.25 per cent. (equivalent to nitrogen, 2.35 to 2.68 per cent.).

	Per cent.
Moisture at 100° C.,	16.98
Total phosphoric acid,	11.59
Soluble phosphoric acid,	8.51
Reverted phosphoric acid,	1.41
Insoluble phosphoric acid,	1.67
Potassium oxide,	1.80
Nitrogen,	2.85
Insoluble matter,	2.23

Valuation per two thousand pounds:—

170.2 pounds of soluble phosphoric acid,	$13 62
28.2 pounds of reverted phosphoric acid,	2 12
33.4 pounds of insoluble phosphoric acid,	1 00
36. pounds of potassium oxide,	1 53
57. pounds of nitrogen,	9 69
	$27 96

George W. Miles' Dry Fish.

(Collected of W. S. Westcott, Amherst, Mass.)

Guaranteed composition: Bone phosphate, 10 to 14 per cent.; ammonia, 10 to 12 per cent. (equivalent to nitrogen, 8.2 to 9.9 per cent.).

	Per cent.
Moisture at 100° C.,	9.00
Total phosphoric acid,	7.07
Soluble phosphoric acid,	.67
Reverted phosphoric acid,	3.36
Insoluble phosphoric acid,	3.04
Nitrogen,	8.59
Insoluble matter,	3.04

Valuation per two thousand pounds : —

13.4 pounds of soluble phosphoric acid . .	$1 07
67.2 pounds of reverted phosphoric acid, ...	5 04
60.8 pounds of insoluble phosphoric acid, ...	1 82
171.8 pounds of nitrogen, ...	29 21
	$37 14

Lister Brothers' United States Phosphate.

(Collected of W. S. Westcott, Amherst, Mass.)

Guaranteed composition : Soluble and available phosphoric acid, 6 to 7 per cent. ; insoluble phosphoric acid, 1 to 1½ per cent. ; potassium oxide, 2 to 2½ per cent. ; ammonia, 1 to 2 per cent. (equivalent to nitrogen, .82 to 1.65 per cent.).

	Per cent.
Moisture at 100° C., ...	17.68
Total phosphoric acid, ...	8.92
Soluble phosphoric acid, ...	6.59
Reverted phosphoric acid, ...	1.58
Insoluble phosphoric acid, ...	.75
Potassium oxide, ...	2.50
Nitrogen, ...	1.93
Insoluble matter, ...	1.56

Valuation per two thousand pounds : —

131.8 pounds of soluble phosphoric acid, . . .	$10 54
31.6 pounds of reverted phosphoric acid, . . .	2 37
15. pounds of insoluble phosphoric acid, . . .	45
50. pounds of potassium oxide, . . .	2 13
38.6 pounds of nitrogen, ...	6 56
	$22 05

Lister's Ammoniated Dissolved Bone Phosphate.

(Collected of W. S. Westcott, Amherst, Mass.)

Guaranteed composition : Available phosphoric acid, 8 to 10 per cent. ; insoluble phosphoric acid, 2 to 3 per cent. ; potassium oxide, 1½ to 2 per cent. ; ammonia, 2 to 2½ per cent. (equivalent to nitrogen, 1.6 to 2 per cent.).

	Per cent.
Moisture at 100° C., ...	13.85
Total phosphoric acid, ...	12.12
Soluble phosphoric acid, ...	8.60
Reverted phosphoric acid, ...	2.13
Insoluble phosphoric acid, ...	1.39
Potassium oxide, ...	1.51
Nitrogen, ...	3.73
Insoluble matter, ...	2.12

Valuation per two thousand pounds: —

172 pounds of soluble phosphoric acid,	$13 76
42.6 pounds of reverted phosphoric acid,	3 20
27.8 pounds of insoluble phosphoric acid,	83
30.2 pounds of potassium oxide,	1 28
74.6 pounds of nitrogen,	12 68
	$31 75

George W. Miles' IXL Ammoniated Bone Superphosphate.

(Collected of W. S. Westcott, Amherst, Mass.)

Guaranteed composition: Available phosphoric acid, 8 to 12 per cent.; insoluble phosphoric acid, 1 to 3 per cent.; potassium oxide, 1 to 3 per cent.; ammonia, 2½ to 4 per cent. (equivalent to nitrogen, 2 to 3.3 per cent.).

	Per cent.
Moisture at 100° C.,	15.53
Total phosphoric acid,	10.52
Soluble phosphoric acid,	5.92
Reverted phosphoric acid,	2.74
Insoluble phosphoric acid,	1.86
Potassium oxide,	3.11
Nitrogen,	2.57
Insoluble matter,	7.14

Valuation per two thousand pounds: —

118.4 pounds of soluble phosphoric acid,	$9 47
54.8 pounds of reverted phosphoric acid,	4 11
37.2 pounds of insoluble phosphoric acid,	1 12
62.2 pounds of potassium oxide,	2 64
51.4 pounds of nitrogen,	8 74
	$26 08

Quinnipiac Pine Island Phosphate.

(Collected of B. F. Bridges, Williamstown, Mass.)

Guaranteed composition: Available phosphoric acid, 8 to 12 per cent.; insoluble phosphoric acid, 1 to 3 per cent.; potassium sulphate, 1 to 2 per cent.; nitrogen, 2 to 3 per cent. (equivalent to ammonia, 2½ to 3½ per cent.).

	Per cent.
Moisture at 100° C.,	17.78
Total phosphoric acid,	10.67
Soluble phosphoric acid,	7.39
Reverted phosphoric acid,	2.13
Insoluble phosphoric acid,	1.15
Potassium oxide,	2.59
Nitrogen,	2.93
Insoluble matter,	4.35

Valuation per two thousand pounds: —

147.8 pounds of soluble phosphoric acid,	$11 82
42.6 pounds of reverted phosphoric acid,	3 20
23. pounds of insoluble phosphoric acid,	69
51.8 pounds of potassium oxide,	2 85
58 6 pounds of nitrogen,	9 96
	$28 52

Darling's Animal Fertilizer.

(Collected of W. S. Westcott, Amherst, Mass.)

Guaranteed composition: Total phosphoric acid, 10 to 12 per cent.; potassium oxide, 4 to 6 per cent.; ammonia, 4 to 6 per cent. (equivalent to nitrogen, 3.3 to 5 per cent.).

	Per cent.
Moisture at 100° C.,	10.75
Total phosphoric acid,	12.76
Soluble phosphoric acid,	.25
Reverted phosphoric acid,	4.46
Insoluble phosphoric acid,	8.05
Potassium oxide,	4.83
Nitrogen,	4.64
Insoluble matter,	1.10

Valuation per two thousand pounds: —

5. pounds of soluble phosphoric acid,	$0 40
89.2 pounds of reverted phosphoric acid,	6 69
161. pounds of insoluble phosphoric acid,	4 83
98.6 pounds of potassium oxide,	4 19
92.8 pounds of nitrogen,	15 78
	$31 89

George W. Miles' Fish and Potash.

(Collected of W S Westcott, Amherst, Mass.)

Guaranteed composition: Available phosphoric acid, 5 to 8 per cent.; insoluble phosphoric acid, 1 to 3 per cent.; potassium sulphate, 4 to 6 per cent.; ammonia, 3 to 6 per cent. (equivalent to nitrogen, 2½ to 5 per cent.).

	Per cent.
Moisture at 100° C.,	16.16
Total phosphoric acid,	9 52
Soluble phosphoric acid,	5 37
Reverted phosphoric acid,	1 99
Insoluble phosphoric acid,	2.16
Potassium oxide,	3.69
Nitrogen,	2.83
Insoluble matter,	6 67

Valuation per two thousand pounds: —

107.4 pounds of soluble phosphoric acid,	$8 59
39.8 pounds of reverted phosphoric acid,	2 99
43.2 pounds of insoluble phosphoric acid,	1 30
73.8 pounds of potassium oxide,	4 06
56.6 pounds of nitrogen,	9 62
	$26 56

H. J. Baker & Brothers' Complete Potato Manure.

(Collected of S. N. and T. E. Hall, Pittsfield, Mass.)

Guaranteed composition: Available phosphoric acid, 5¾ per cent.; potassium oxide, 10 per cent.; sodium oxide, 1 per cent.; ammonia, 4 per cent. (equivalent to nitrogen, 3.3 per cent.).

	Per cent.
Moisture at 100° C.,	10.43
Total phosphoric acid,	7.29
Soluble phosphoric acid,	4.00
Reverted phosphoric acid,	3.16
Insoluble phosphoric acid,	.13
Potassium oxide,	7.63
Nitrogen,	4.26
Insoluble matter,	1.88

Valuation per two thousand pounds: —

80. pounds of soluble phosphoric acid,	$6 40
63.2 pounds of reverted phosphoric acid,	4 74
2.6 pounds of insoluble phosphoric acid,	8
152.6 pounds of potassium oxide,	6 49
85.2 pounds of nitrogen,	14 48
	$32 19

Bay State Fertilizer.

(Clark's Cove Guano Company, New Bedford, Mass.; collected of Richardson & Flagg, North Adams, Mass.)

Guaranteed composition: Moisture, 10 to 18 per cent.; total phosphoric acid, 9.5 to 14 per cent.; soluble phosphoric acid, 7 to 8.5 per cent.; reverted phosphoric acid, 1 to 2½ per cent.; insoluble phosphoric acid, 1.5 to 3 per cent.; potassium oxide, 2 to 3 per cent.; nitrogen, 2.1 to 2.8 per cent. (equivalent to ammonia, 2.5 to 3.5 per cent.).

	Per cent.
Moisture at 100° C.,	17.60
Total phosphoric acid,	10.66
Soluble phosphoric acid,	8.95

	Per cent.
Reverted phosphoric acid,	1.27
Insoluble phosphoric acid,	.44
Potassium oxide,	2.36
Nitrogen,	2.81
Insoluble matter,	4.38

Valuation per two thousand pounds: —

179. pounds of soluble phosphoric acid,	$14 32
25.4 pounds of reverted phosphoric acid,	1 91
8.8 pounds of insoluble phosphoric acid,	26
47.2 pounds of potassium oxide,	2 00
56.2 pounds of nitrogen,	9 55
	$28 04

Cumberland Superphosphate.

(Cumberland Bone Company, Portland, Me.; collected of W. H. Lalley & Co., North Adams, Mass.)

Guaranteed composition: Moisture, 14 to 18 per cent.; total phosphoric acid, 11 to 14 per cent.; soluble phosphoric acid, 5 to 7 per cent.; reverted phosphoric acid, 1 to 3 per cent.; insoluble phosphoric acid, 2 to 4 per cent.; potassium sulphate, 2 to 3 per cent.; nitrogen, 2 to 3 per cent. (equivalent to ammonia, 2.44 to 3.88 per cent.).

	Per cent.
Moisture at 100° C.,	18.18
Total phosphoric acid,	13.16
Soluble phosphoric acid,	7.39
Reverted phosphoric acid,	3.39
Insoluble phosphoric acid,	2.38
Potassium oxide,	1.85
Nitrogen,	2.37
Insoluble matter,	5.02

Valuation per two thousand pounds: —

147.8 pounds of soluble phosphoric acid,	$11 82
67.8 pounds of reverted phosphoric acid,	5 09
47.6 pounds of insoluble phosphoric acid,	1 43
37 pounds of potassium oxide,	2 04
47.4 pounds of nitrogen,	8 06
	$28 44

"Americus" Brand Ammoniated Bone Superphosphate.

(Williams, Clark & Co., New York; collected of J. A. Brewer, Great Barrington, Mass.)

Guaranteed composition: Total phosphoric acid, 11 to 13 per cent.; soluble phosphoric acid, 7 to 8 per cent.; re-

verted phosphoric acid, 3 to 4 per cent.; insoluble phosphoric acid, 1 to 3 per cent.; potassium oxide, 2 to 3 per cent. (equivalent to potassium sulphate, 4 to 6 per cent.); nitrogen, 2.35 to 3.3 per cent. (equivalent to ammonia, 3 to 4 per cent.); magnesium sulphate, 3 to 4 per cent.).

	Per cent.
Moisture at 100° C.,	13.41
Total phosphoric acid,	11.10
Soluble phosphoric acid,	9.47
Reverted phosphoric acid,	1.18
Insoluble phosphoric acid,	.45
Potassium oxide,	2.80
Nitrogen,	3.04
Insoluble matter,	.89

Valuation per two thousand pounds: —

189.4 pounds of soluble phosphoric acid,	$15 15
23.6 pounds of reverted phosphoric acid,	1 77
9. pounds of insoluble phosphoric acid,	27
56. pounds of potassium oxide,	3 08
60.8 pounds of nitrogen,	10 34
	$30 61

Adams' Ground Bone.

(Adams & Thomas, Springfield, Mass.; collected of C. W. Shaw, Springfield, Mass.)

Guaranteed composition: Total phosphoric acid, 18 to 20 per cent.; nitrogen, 4 to 5 per cent.

	Per cent.
Moisture at 100° C.,	4.95
Total phosphoric acid,	18.77
Soluble phosphoric acid,	.10
Reverted phosphoric acid,	6.50
Insoluble phosphoric acid,	12.17
Nitrogen,	3.95
Insoluble matter,	2.27

Valuation per two thousand pounds: —

2 pounds of soluble phosphoric acid,	$0 16
130 pounds of reverted phosphoric acid,	9 75
243 pounds of insoluble phosphoric acid,	12 17
79 pounds of nitrogen,	11 83
	$33 91

Bradley's XL Superphosphate of Lime.

(Collected of Merritt I. Wheeler, Great Barrington, Mass.)

Guaranteed composition: Total phosphoric acid, 11 to 14 per cent.; soluble phosphoric acid, 7 to 8 per cent.; re-

verted phosphoric acid, 2 to 3 per cent.; nitrogen, 2½ to 3¼ per cent. (equivalent to ammonia, 3 to 4 per cent.); potassium sulphate, 3.7 to 5.55 per cent. (equivalent to potassium oxide, 2 to 3 per cent.).

	Per cent.
Moisture at 100° C.,	17.62
Total phosphoric acid,	13.28
Soluble phosphoric acid,	8.96
Reverted phosphoric acid,	2.87
Insoluble phosphoric acid,	2.25
Potassium oxide,	1.60
Nitrogen,	2.73
Insoluble matter,	5.48

Valuation per two thousand pounds: —

163.2 pounds of soluble phosphoric acid,	$13 06
57.4 pounds of reverted phosphoric acid,	4 31
45. pounds of insoluble phosphoric acid,	1 35
32. pounds of potassium oxide,	1 76
54.6 pounds of nitrogen,	9 28
	$29 76

Extra Fine Ground Bone with Potash. (*Circle Brand.*)

(Bradley Fertilizer Company, Boston; collected of H. P. Lucas, Pittsfield, Mass.)

Guaranteed composition: Moisture 10 to 20 per cent.; total phosphoric acid, 8 to 12 per cent.; nitrogen, 2.25 to 3.25 per cent.; potassium oxide, 2 to 3 per cent.

	Per cent.
Moisture at 100° C.,	7.08
Total phosphoric acid,	12.65
Soluble phosphoric acid,	3.07
Reverted phosphoric acid,	5.18
Insoluble phosphoric acid,	4 40
Potassium oxide,	2 20
Nitrogen,	2.18
Insoluble matter,	2.82

Valuation per two thousand pounds: —

61.4 pounds of soluble phosphoric acid,	$4 91
103.6 pounds of reverted phosphoric acid,	7 77
88. pounds of insoluble phosphoric acid,	2 64
44. pounds of potassium oxide,	1 87
43 6 pounds of nitrogen,	7 41
	$24 60

Darling's Ground Bone.

(Collected at Experiment Station, Amherst, Mass.)

Guaranteed composition: Total phosphoric acid, 22 to 25 per cent.; bone phosphate, 52 to 55 per cent.; ammonia, 4 to 5 per cent. (equivalent to nitrogen, 3.5 to 4.5 per cent.).

	Per cent.
Moisture at 100° C.,	4.12
Total phosphoric acid,	24.78
Soluble phosphoric acid,	.32
Reverted phosphoric acid,	7.81
Insoluble phosphoric acid,	16.65
Nitrogen,	3.37
Insoluble matter,	.70

Valuation per two thousand pounds: —

6.4 pounds of soluble phosphoric acid,	$0 51
156.2 pounds of reverted phosphoric acid,	11 72
333. pounds of insoluble phosphoric acid,	16 65
67.4 pounds of nitrogen,	10 11
	$38 99

H. Preston & Son's Ammoniated Superphosphate.

(Collected of C. A. Dewy, Pittsfield, Mass.)

Guaranteed composition: Reverted phosphoric acid, 9 to 11 per cent.; potassium oxide, 2 to 3 per cent.; ammonia, 3 to 4 per cent. (equivalent to nitrogen, 2.5 to 3.3 per cent.).

	Per cent.
Moisture at 100° C.,	15.09
Total phosphoric acid,	12.24
Soluble phosphoric acid,	7.07
Reverted phosphoric acid,	2.19
Insoluble phosphoric acid,	2.98
Potassium oxide,	.16
Nitrogen,	3.07
Insoluble matter,	3.14

Valuation per two thousand pounds: —

141.4 pounds of soluble phosphoric acid,	$11 31
43.8 pounds of reverted phosphoric acid,	3 29
59.6 pounds of insoluble phosphoric acid,	1 79
3.2 pounds of potassium oxide,	14
61.4 pounds of nitrogen,	10 44
	$26 97

Bowker's Lawn and Garden Dressing.

(Collected of H. P. Lucas, Pittsfield, Msss.)

Guaranteed composition: Available phosphoric acid, 5 to 6 per cent.; potassium oxide, 5 to 6 per cent.; ammonia, 5 to 6 per cent. (equivalent to nitrogen, 4 to 5 per cent.).

	Per cent.
Moisture at 100° C.,	11.43
Total phosphoric acid,	14.79
Soluble phosphoric acid,	12.19
Reverted phosphoric acid,	2.23
Insoluble phosphoric acid,	.38
Potassium oxide,	3.45
Nitrogen,	3.56
Insoluble matter,	1.95

Valuation per two thousand pounds:—

243.8 pounds of soluble phosphoric acid,	$19 50
44.4 pounds of reverted phosphoric acid,	3 33
7.6 pounds of insoluble phosphoric acid,	23
69. pounds of potassium oxide,	2 93
71.2 pounds of nitrogen,	12 10
	$38 09

E. Frank Coe's High Grade Ammoniated Bone Superphosphate.

(Collected of D. J. Barber, North Adams, Mass.)

Guaranteed composition: Available phosphoric acid, 9 to 12 per cent.; insoluble phosphoric acid, 1 to 2 per cent.; ammonia, 2½ to 3 per cent. (equivalent to nitrogen, 2 to 2½ per cent.).; potassium sulphate, 2 to 3 per cent.

	Per cent.
Moisture at 100° C.,	10.20
Total phosphoric acid,	12.28
Soluble phosphoric acid,	7.74
Reverted phosphoric acid,	2.36
Insoluble phosphoric acid,	2.18
Potassium oxide,	1.87
Nitrogen,	2.46
Insoluble matter,	5.65

Valuation per two thousand pounds:—

154.8 pounds of soluble phosphoric acid,	$12 38
47.2 pounds of reverted phosphoric acid,	3 54
43.6 pounds of insoluble phosphoric acid,	1 31
37.4 pounds of potassium oxide,	2 06
49.2 pounds of nitrogen,	8 36
	$27 65

Bowker's Dissolved Boneblack.

(Collected of Pease & Easterbrook, Fall River, Mass.)

Guaranteed composition: Soluble phosphoric acid, 15 to 18 per cent.

	Per cent.
Moisture at 100° C.,	15.90
Total phosphoric acid,	15.72
Soluble phosphoric acid,	14.13
Reverted phosphoric acid,	1.14
Insoluble phosphoric acid,	.45
Insoluble matter,	2.78

Valuation per two thousand pounds:—

282.6	pounds of soluble phosphoric acid,	$22 61
22.8	pounds of reverted phosphoric acid,	1 71
9.	pounds of insoluble phosphoric acid,	27
		$24 59

Pratt's Magnesia Fertilizing Compound.

(Eureka Fertilizer Company, Boston; collected of John J. Pratt, Wakefield, Mass.)

Guaranteed composition: Total phosphoric acid, 2 per cent.; potassium oxide, 2 per cent.; nitrogen, 2 per cent.; calcium oxide, 12 per cent.; magnesium oxide, 17 per cent.; sulphuric acid, 17 per cent.

	Per cent.
Moisture at 100° C.,	1.63
Total phosphoric acid,	1.92
Potassium oxide,	1.20
Nitrogen,	1.77
Calcium oxide,	11.45
Magnesium oxide,	16.90
Sulphuric acid,	14.08
Carbonic acid,	3.00
Insoluble matter,	30.23

Valuation per two thousand pounds:—

38.4	pounds of phosphoric acid,	$2 30
24.	pounds of potassium oxide,	1 00
35.4	pounds of nitrogen,	6 02
340.	pounds of magnesium oxide,	16 00
		$25 32

Sea Fowl. [HD]

(Bradley Fertilizer Company, Boston; collected of D. J. Wright, Northampton, Mass.)

Guaranteed composition: Total phosphoric acid, 11 to 14 per cent.; soluble phosphoric acid, 7 to 8 per cent.; re-

verted phosphoric acid, 2 to 3 per cent.; insoluble phosphoric acid, 2 to 3 per cent.; potassium oxide, 2 to 3 per cent. (equivalent to potassium sulphate, 3.7 to 5.55 per cent.); nitrogen, 2½ to 3½ per cent. (equivalent to ammonia, 3 to 4 per cent.).

	Per cent.
Moisture at 100° C.,	12.08
Total phosphoric acid,	13.49
Soluble phosphoric acid,	9.08
Reverted phosphoric acid,	2.94
Insoluble phosphoric acid.	1.47
Potassium oxide,	1.42
Nitrogen,	2.21
Insoluble matter,	7.18

Valuation per two thousand pounds:—

181.6 pounds of soluble phosphoric acid,	$14 53
58.8 pounds of reverted phosphoric acid,	4 41
29.4 pounds of insoluble phosphoric acid,	88
28.4 pounds of potassium oxide,	1 56
44.2 pounds of nitrogen,	7 51
	$28 89

Bradley's Dry Fish Guano.

(Collected of D. J. Wright, Northampton, Mass.)

Guaranteed composition: Total phosphoric acid, 6 to 8 per cent.; ammonia, 10 to 12 per cent. (equivalent to nitrogen, 8 to 10 per cent.).

	Per cent.
Moisture at 100° C.,	9.41
Total phosphoric acid,	6.86
Soluble phosphoric acid,	1.38
Reverted phosphoric acid,	3.37
Insoluble phosphoric acid,	2.11
Nitrogen,	8.61
Insoluble matter,	3.60

Valuation per two thousand pounds:—

27.6 pounds of soluble phosphoric acid,	$2 21
67.4 pounds of reverted phosphoric acid,	5 06
42.2 pounds of insoluble phosphoric acid,	2 11
172.2 pounds of nitrogen,	29 27
	$38 65

Standard Fertilizer.

(Collected of H. C. Haskell, Deerfield, Mass.)

Guaranteed composition: Available phosphoric acid, 9 to 13 per cent.; insoluble phosphoric acid, 2 to 3 per cent.;

potassium oxide, 2.09 per cent.; ammonia, 3 to 4 per cent. (equivalent to nitrogen, 2.5 to 3.3 per cent.).

	Per cent.
Moisture at 100° C.,	13.10
Total phosphoric acid,	13.41
Soluble phosphoric acid,	8.70
Reverted phosphoric acid,	2.81
Insoluble phosphoric acid,	1.90
Potassium oxide,	2.09
Nitrogen,	3.08
Insoluble matter,	5.00

Valuation per two thousand pounds: —

174. pounds of soluble phosphoric acid,	$13 92
56.2 pounds of reverted phosphoric acid,	4 22
38. pounds of insoluble phosphoric acid,	1 14
41.8 pounds of potassium oxide,	1 78
61.6 pounds of nitrogen,	10 47
	$31 53

Whittimore's Complete Manure.

(Whittimore Brothers, Wayland, Mass.; collected of H. P. Rodgers, South Sudbury, Mass.)

Guaranteed composition: Available phosphoric acid, 8 to 12 per cent.; potassium oxide, 3 to 5 per cent.; ammonia, 2 to 4 per cent. (equivalent to nitrogen, 1.6 to 3 3 per cent.).

	Per cent.
Moisture at 100° C.,	12.38
Total phosphoric acid,	14.11
Soluble phosphoric acid,	7.77
Reverted phosphoric acid.	5.91
Insoluble phosphoric acid,	.43
Potassium oxide,	2.31
Nitrogen,	2.66
Insoluble matter,	2.05

Valuation per two thousand pounds: —

155.4 pounds of soluble phosphoric acid.	$12 43
118.2 pounds of reverted phosphoric acid.	8 87
8.6 pounds of insoluble phosphoric acid,	26
46.2 pounds of potassium oxide,	1 96
53 2 pounds of nitrogen,	9 04
	$32 56

Ground Bone.

(Hargrave's Manufacturing Company, Fall River, Mass.; collected at Mill.)

Guaranteed composition: Total phosphoric acid, 18.8 per cent.; soluble phosphoric acid, .51 per cent.; reverted phosphoric acid, 3.61 per cent.; insoluble phosphoric acid, 14.67 per cent.; nitrogen, 3.93 per cent. (equivalent to ammonia, 4.77 per cent.).

	Per cent.
Moisture at 100° C.,	8.60
Total phosphoric acid,	23.88
Soluble phosphoric acid,	none.
Reverted phosphoric acid,	7.88
Insoluble phosphoric acid,	16.00
Nitrogen,	3.82
Insoluble matter,	.47

Valuation per two thousand pounds: —

157.6 pounds of reverted phosphoric acid,	$11 82
320. pounds of insoluble phosphoric acid,	16 00
76.4 pounds of nitrogen,	11 46
	$39 28

Breck's Lawn and Garden Dressing.

(Standard Fertilizer Company, Boston; collected of Joseph Breck & Sons, Boston, Mass.)

Guaranteed composition: Total phosphoric acid, 8 to 9 per cent.; potassium oxide, 4 to 6 per cent.; ammonia, 5 to 6 per cent. (equivalent to nitrogen, 4 to 5 per cent.).

	Per cent.
Moisture at 100° C.,	7.60
Total phosphoric acid,	12.51
Soluble phosphoric acid,	7.07
Reverted phosphoric acid,	3.64
Insoluble phosphoric acid,	1.80
Potassium oxide,	3.86
Nitrogen,	5.09
Insoluble matter,	2.63

Valuation per two thousand pounds: —

141.4 pounds of soluble phosphoric acid.	$11 31
72.8 pounds of reverted phosphoric acid,	5 46
36. pounds of insoluble phosphoric acid,	1 08
77 2 pounds of potassium oxide,	3 28
101.8 pounds of nitrogen,	17 31
	$38 44

Breck's Top Dressing.

(Standard Fertilizer Company, Boston; collected of Joseph Breck & Sons, Boston, Mass.)

Guaranteed composition: Total phosphoric acid, 6 to 8 per cent.; soluble phosphoric acid, 5 to 6 per cent.; potassium oxide, 2 to 3½ per cent.; ammonia, 7 to 8 per cent. (equivalent to nitrogen, 6 to 6.6 per cent.).

	Per cent.
Moisture at 100° C.,	11.83
Total phosphoric acid,	10.78
Soluble phosphoric acid,	7.20
Reverted phosphoric acid,	1.43
Insoluble phosphoric acid,	2.15
Potassium oxide,	2.02
Nitrogen,	6.41
Insoluble matter,	3.50

Valuation per two thousand pounds: —

144. pounds of soluble phosphoric acid,	$11 52
28.6 pounds of reverted phosphoric acid,	2 15
43. pounds of insoluble phosphoric acid,	1 29
40.4 pounds of potassium oxide,	1 72
128.2 pounds of nitrogen,	21 79
	$38 47

Allen's Fertilizer.

(Allen, Richardson & Co., Boston; collected of Allen, Richardson & Co., 44 Kilby Street, Boston, Mass.)

Guaranteed composition: Total phosphoric acid, 6 to 9 per cent.; potassium oxide, 4 to 5 per cent.; ammonia, 2½ to 3½ per cent. (equivalent to nitrogen, 2 to 2.9 per cent.).

	Per cent.
Moisture at 100° C.,	31.35
Total phosphoric acid,	7.22
Soluble phosphoric acid,	5.34
Reverted phosphoric acid,	1.20
Insoluble phosphoric acid,	.68
Potassium oxide,	3.84
Nitrogen,	3.17
Insoluble matter,	3.32

Valuation per two thousand pounds: —

106.8 pounds of soluble phosphoric acid,	$8 54
24. pounds of reverted phosphoric acid,	1 80
13.6 pounds of insoluble phosphoric acid,	41
76.8 pounds of potassium oxide,	3 26
63.4 pounds of nitrogen,	10 78
	$24 79

Acushnet Fertilizer.

(Manufactured by George Hathaway, Acushnet, Mass.; collected of George Hathaway, Acushnet, Mass.)

No guaranty given.

	Per cent.
Moisture at 100° C,	6.40
Total phosphoric acid,	2.33
Soluble phosphoric acid,	none.
Reverted phosphoric acid,	1.55
Insoluble phosphoric acid,	.78
Potassium oxide,	2.63
Nitrogen,	1.74
Insoluble matter,	64.07

Valuation per two thousand pounds: —

31. pounds of reverted phosphoric acid,	$2 32
15.6 pounds of insoluble phosphoric acid,	47
52.6 pounds of potassium oxide,	2 24
34 8 pounds of nitrogen,	5 92
	$10 95

Davis' Superphosphate and Animal Charcoal Fertilizer.

(Manufactured by Jane M. Davis, New Bedford, Mass.; collected at Factory.)

Guaranteed composition: Total phosphoric acid, 14.97 per cent.; reverted phosphoric acid, 10.61 per cent.; insoluble phosphoric acid, 4.36 per cent.; potassium oxide, 3.97 per cent.; nitrogen, 2.39 per cent.; sulphuric acid, 16.38 per cent.

	Per cent.
Moisture at 100° C.,	17.82
Total phosphoric acid,	9.82
Soluble phosphoric acid,	.38
Reverted phosphoric acid,	5.38
Insoluble phosphoric acid,	4.06
Potassium oxide,	6 81
Nitrogen,	3.03
Sulphuric acid,	6.18
Insoluble matter,	8.44

Valuation per two thousand pounds: —

7 6 pounds of soluble phosphoric acid,	$0 61
107.6 pounds of reverted phosphoric acid,	8 07
81.2 pounds of insoluble phosphoric acid,	2 44
136.2 pounds of potassium oxide,	5 79
60.6 pounds of nitrogen,	10 30
	$27 21

Standard Superphosphate.

(Standard Fertilizer Company, Boston; collected of George A. Cobb, Acushnet, Mass.)

Guaranteed composition: Available phosphoric acid, 9 to 13 per cent.; insoluble phosphoric acid, 2 to 3 per cent.;

potassium oxide, 2½ to 4 per cent.; ammonia, 3 to 4 per cent. (equivalent to nitrogen, 2.5 to 3.3 per cent.).

	Per cent.
Moisture at 100° C.,	10.78
Total phosphoric acid,	13.19
Soluble phosphoric acid,	9.21
Reverted phosphoric acid,	2.76
Insoluble phosphoric acid,	1.22
Potassium oxide,	2.01
Nitrogen,	3.08
Insoluble matter,	5.05

Valuation per two thousand pounds: —

184.2 pounds of soluble phosphoric acid,	$14 74
55.2 pounds of reverted phosphoric acid,	4 14
24.4 pounds of insoluble phosphoric acid,	73
40.2 pounds of potassium oxide,	1 71
61.6 pounds of nitrogen,	10 47
	$31 79

Standard Superphosphate.

(Standard Fertilizer Company, Boston; collected of C. H. Thompson, Boston, Mass.)

Guaranteed composition: Available phosphoric acid, 9 to 13 per cent.; insoluble phosphoric acid, 2 to 3 per cent.; potassium oxide, 2½ to 4 per cent.; ammonia, 3 to 4 per cent. (equivalent to nitrogen, 2½ to 3.3 per cent.).

	Per cent.
Moisture at 100° C.,	14.37
Total phosphoric acid,	13.54
Soluble phosphoric acid,	8.73
Reverted phosphoric acid,	2.91
Insoluble phosphoric acid,	1.90
Potassium oxide,	1.94
Nitrogen,	3.18
Insoluble matter,	4.60

Valuation per two thousand pounds: —

174.6 pounds of soluble phosphoric acid,	$13 97
58.2 pounds of reverted phosphoric acid,	4 37
38. pounds of insoluble phosphoric acid,	1 14
38.8 pounds of potassium oxide,	1 65
63.6 pounds of nitrogen,	10 81
	$31 94

Baugh's Economical Fertilizer.

(Manufactured by Baugh & Sons, Philadelphia; collected of J. C. Stanley, Newburyport, Mass.)

Guaranteed composition: Available phosphoric acid, 5 to 6 per cent.; bone phosphate, 7 to 8 per cent.; potassium sulphate, 4 to 5 per cent.; ammonia, 2 to 2½ per cent. (equivalent to nitrogen, 1.7 to 2 per cent.).

	Per cent.
Moisture at 100° C.,	7.90
Total phosphoric acid,	12.58
Soluble phosphoric acid,	5.28
Reverted phosphoric acid,	1.96
Insoluble phosphoric acid,	5.34
Potassium oxide,	.12
Nitrogen,	2.49
Insoluble matter,	4.62

Valuation per two thousand pounds: —

105.6 pounds of soluble phosphoric acid,	$8 45
39.2 pounds of reverted phosphoric acid,	2 94
106.8 pounds of insoluble phosphoric acid,	3 20
2.4 pounds of potassium oxide,	11
49.8 pounds of nitrogen,	8 47
	$23 17

Baugh's Double-Eagle Phosphate.

(Baugh & Sons, Philadelphia, Pa.; collected of J. C. Stanley, Newburyport, Mass.)

Guaranteed composition: Available phosphoric acid, 5 to 6 per cent.; bone phosphate, 7 to 8 per cent.; ammonia, 2 to 2½ per cent. (equivalent to nitrogen, 1.7 to 2 per cent.).

	Per cent.
Moisture at 100° C.,	11.72
Total phosphoric acid,	10.41
Soluble phosphoric acid,	3.68
Reverted phosphoric acid,	3.10
Insoluble phosphoric acid,	3.63
Nitrogen,	2.02
Insoluble matter,	4.45

Valuation per two thousand pounds: —

73.6 pounds of soluble phosphoric acid,	$5 89
62. pounds of reverted phosphoric acid,	4 65
72.6 pounds of insoluble phosphoric acid,	2 18
40.4 pounds of nitrogen,	6 87
	$19 59

Baugh's Dissolved Animal Bones.

(Baugh & Sons, Philadelphia, Pa.; collected of J. C. Stanley, Newburyport, Mass.)

Guaranteed composition: Available phosphoric acid, 10 to 12 per cent.; ammonia, 3 to 3½ per cent. (equivalent to nitrogen, 2.5 to 2.9 per cent.).

	Per cent.
Moisture at 100° C.,	4.80
Total phosphoric acid,	17.44
Soluble phosphoric acid,	2.43
Reverted phosphoric acid,	11.99
Insoluble phosphoric acid,	3.02
Nitrogen,	3.38
Insoluble matter,	7.17

Valuation per two thousand pounds: —

48.6 pounds of soluble phosphoric acid,	$3 89
239.8 pounds of reverted phosphoric acid,	17 99
60.4 pounds of insoluble phosphoric acid,	3 02
67 6 pounds of nitrogen,	10 14
	$35 04

Stearns & Co.'s Ammoniated Bone Superphosphate.

(Collected of Wilson & Holden, Worcester, Mass.)

Guaranteed composition: Available phosphoric acid, 8 to 11 per cent.; insoluble phosphoric acid, 1 to 3 per cent.; ammonia, 2.75 to 3.5 per cent. (equivalent to nitrogen, 2.3 to 2.9 per cent.).

	Per cent.
Moisture at 100° C.,	11.10
Total phosphoric acid,	12.82
Soluble phosphoric acid,	7.87
Reverted phosphoric acid,	2.34
Insoluble phosphoric acid,	2.61
Potassium oxide,	2.53
Nitrogen,	2.58
Insoluble matter,	4.15

Valuation per two thousand pounds: —

157 4 pounds of soluble phosphoric acid,	$12 59
46.8 pounds of reverted phosphoric acid,	3 51
52 2 pounds of insoluble phosphoric acid,	1 57
51.6 pounds of potassium oxide,	2 19
50.6 pounds of nitrogen,	8 60
	$28 46

Jefferd's Fine Ground Bones.

(Collected at Experiment Station, Amherst, Mass.)

Guaranteed composition: Total phosphoric acid, 27 to 30 per cent.; ammonia, 3 to 4 per cent. (equivalent to nitrogen, 2.5 to 3.3 per cent.).

	Per cent.
Moisture at 100° C.,	3.48
Total phosphoric acid,	27.38
Soluble phosphoric acid,	.61
Reverted phosphoric acid,	9.40
Insoluble phosphoric acid,	17.37
Nitrogen,	2.85
Insoluble matter,	.46

Valuation per two thousand pounds: —

12 2 pounds of soluble phosphoric acid,	$0 98
188. pounds of reverted phosphoric acid,	14 10
347.4 pounds of insoluble phosphoric acid,	17 37
57. pounds of nitrogen,	8 55
	$41 00

Swift Sure Guano.

(M. L. Shoemaker, Philadelphia; collected of H. W. Gaylord, South Hadley Falls, Mass.)

Guaranteed composition: Ammonia, 8 to 9 per cent. (equivalent to nitrogen, 6.6 to 7.4 per cent.); total phosphoric acid, 13 to 14 per cent.

	Per cent.
Moisture at 100° C.,	5.24
Total phosphoric acid,	15.07
Soluble phosphoric acid,	.29
Reverted phosphoric acid,	3.57
Insoluble phosphoric acid,	11.21
Nitrogen,	6.20
Insoluble matter,	1.23

Valuation per two thousand pounds: —

5.8 pounds of soluble phosphoric acid,	$4 64
71.4 pounds of reverted phosphoric acid,	5 36
224.2 pounds of insoluble phosphoric acid,	6 73
124. pounds of nitrogen,	21 08
	$37 81

C. A. GOESSMANN,
State Inspector.

ANNUAL REPORT

OF THE

CATTLE COMMISSIONERS.

To the Senate and House of Representatives of the Commonwealth of Massachusetts.

The undersigned Cattle Commissioners submit their annual report.

Neat Stock.

Though contagious pleuro-pneumonia has caused serious loss to the cattle interests of several of our sister States, it has not made its appearance in any of our herds. In the early fall, no little alarm was created by rumors of an outbreak of the disease near Chicago, and great fear expressed lest cattle in transportation to Eastern markets should become infected and bring it here. To ascertain the condition of affairs there and our real danger, if any existed, correspondence was had with the United States Commissioner of Agriculture and the officers at the West who had charge of the diseased and infected cattle. We learned that all infected herds were securely quarantined miles away from the lines and marts of traffic, and that though for want of legal authority and pecuniary means it was next to impossible to "stamp out" the disease at once, yet they were confident it would be controlled, and there was no reason to fear that we should be injured thereby. It has been our endeavor to keep informed in relation to the condition of affairs in that section, so that if our safety required it, we could quarantine all Western cattle as soon as they crossed our State lines. We shall always be in more or less danger so long as this disease exists in any of our border States or along the great lines of cattle transport, however remote, and our interests dictate the most hearty co-operation in "stamping it out" in all the States, by urging the Congress of the United States to make large appropriations for the purpose, and the enactment of better laws for the regulation of our inter-state commerce. No cases have occurred of other fully recognized contagious disease. As in former years, we have been frequently notified of pulmonary disease among this class of animals, which it was feared might take on a contagious type; but in none of them was that the case, unless it has been in the form of tuberculosis. This finds a place in the category of contagious diseases that has not as yet been fully appreciated by the farmers of this or any other State, from the fact that it is so little understood, its period of incubation so long, and the general susceptibility of animals so opposite. As regards its heredity there are so many indisputable facts to prove it, that at the present time it can hardly be questioned. It will develop itself in other animals if they have in any way taken the specific germ into their system, and the constitution of the animal is such as to allow of its growth. Experiments have proved that a large proportion of this class of animals is susceptible to its ravages if they are inoculated. Its period of incubation is uncertain, varying from a month or two to a year; and, in the former, death may occur in a short time, while in the latter, the animal may live to old age, provided no complications occur. The milk and beef of animals in any stage of this disease should be proscribed, as it is transmittable to man. Bad hygienic conditions increase the activity of the trouble. The disease is not confined to any special organ or organs; it is extremely difficult to detect it in its earliest stages, but as the lungs and pleura are more generally involved, the first thing noticed will be a dry, deep cough, though feeble, and not usually accompanied with a discharge from the nose. When the joints are affected there is lameness, and should the hock joints be the seat of the disease, there will be a wasting of the tissues of the posterior part of the body. The lymphatics are always involved, and some forms of its development are not unlike scrofula.

Notwithstanding all that is certainly known of the disease and the great losses it entails, yet it is surrounded with such obscurity and uncertainty, and presents such apparently insurmountable obstacles to its eradication, that we have made no direct attempts to combat it; but some of our citizens, to rid their herds and premises of the pest, have, during the past year, destroyed many thousand dollars worth of cattle. It may not be beyond the limits of our duty, and result in some good, if we here make mention of a disease which made its appearance in Methuen, causing the death of several animals and leading the community to fear the presence of contagion. A post mortem disclosed the fact of intense inflammation of the stomach and bowels, and indicated the presence of mineral poison. A portion of a stomach and its contents was sent to Professor Goessmann at the Massachusetts Experiment Station, with the information that the feed of the animal had been meal and ninety pounds of ensilage per day, and the request that he would test for mineral irritants. In due time Professor Goessmann reported, "We have carefully tested your samples of contents of stomach and of corn ensilage. The contents of the stomach are free from any metallic poison, and the corn ensilage contains no extraordinary amount of acid. Corn ensilage ought not to be fed in such large quantities, thirty-five to forty pounds per day with hay and grain or shorts gives the best results, so far as the flow of milk and the general good condition of the cows are concerned." The report indicated clearly that the mucus inflammation was caused by the acid in the large quantity of the ensilage fed; and lessening the amount the trouble disappeared.

GLANDERS.

The disease known as glanders or farcy has prevailed to a greater extent than in any previous year. Seventy-five animals have been condemned and destroyed by this Board, and many individual owners who were convinced their animals were infected with the disease have caused them to be killed without the intervention of the law. But all horse owners are not careful of their own safety or that of the public, and in our attempts to eradicate the disease we have had many obstacles to contend with. In many of our cities the municipal officers utterly disregard the specific provisions of law relating to this disease. When they are notified of cases they are referred to the Board of Health, or the Board is directed to take cognizance of them without the knowledge or intervention of the mayor and aldermen. It may be that it is assumed that as such Boards are empowered to take measures to abate nuisances and guard the public health, they would therefore have authority to take a horse suspected of being glandered from its owner and destroy it. But their powers extend only to infected persons and things, and it is morally certain that the owner of every horse they destroy has good cause for action against them at law; and as is provided in section 15, chapter 90, of the Public Statutes, and sections 1 and 2 of chapter 148 of the Acts of 1885, all these persons are liable to fine and imprisonment in every case where they fail to notify the Cattle Commissioners of their knowledge of this contagion. Though without warrant of law Boards of Health have doubtless destroyed some dangerous animals, but the practice tends to secrete a full knowledge of the extent of the disease from the Commissioners, and to weaken or destroy the force of their regulations. In several instances in the towns individuals whose horses have been legally isolated on suspicion, or condemned as glandered, have secreted or removed them to other localities before they could be destroyed; and in one case the keeper of such a removed horse contracted and died of this loathsome disease. Assuming it to be in the line of our duty, we have caused prosecutions to be instituted in two of these cases, where the facts could be proved. One of these has been carried to conviction, and a bill of indictment has been preferred by a grand jury in the other, which, on trial, will doubtless lead to the same result.

Hog Cholera.

We have been called to take charge and direct in more than a hundred cases of hog cholera, involving the safety of many hundreds of animals in the infected herds, as well as all the swine stock in the vicinity of their occurrence. While the eastern part of the State has not been exempt from the disease, much the largest proportion of the cases has been in the four western counties. In a former report the specific nature and characteristics of this disease were described quite fully, and its origin and manner of propagation in this State, and our experience the present year has only served to confirm the opinion then expressed. Its outbreak here is very peculiar, and it is not as malignant and fatal as in the Middle and Western States. Although it more generally makes its appearance near our large villages and cities, where the swill from hotels and boarding-houses is carried into the country to be used as swine food, yet we have quite frequently been called to cases in remote and isolated localities, where all the animals were home bred and contact with other herds impossible. The inference in such cases is that the disease is sporadic rather than contagious, or that a mistake has been made in the diagnosis. But our oft-repeated post mortems, and those of the heads of our veterinary colleges to whom specimens have been sent, prove beyond a doubt that it is the true swine plague of the West; and, with few exceptions, we have been able to trace the infection in these isolated localities to the travelling meat-carts and to the markets from which Western pork is sold. By strict isolation and acid treatment of the infected animals we have been able in all cases to prevent the transmission of the contagion to adjacent herds, and to save fifty per cent. of them; and were it not that the seed germs were brought to us from week to week, the trouble would have ceased long ago. Our law for the suppression of contagious diseases among domestic animals was originally enacted only to meet the great emergency caused by the outbreak of contagious pleuro-pneumonia in 1860. Heroic treatment was believed to be necessary in dealing with that fell disease, and great powers, tending to the destruction of all infected herds, were given to mayors and aldermen, to selectmen and commissioners. Doubtless the controlling purpose of the law was to save the property of the general public from the calamitous ravages of a spreading contagion, by killing and paying for the healthy animals of a person who had been so unfortunate as to have his cattle contaminated. In practice, however, it was to a certain extent a measure of compensation to the owner for property which had already lost its value; for the tainted herd had no real market value, and a portion of every such herd would be a final loss to their owner in consequence of death by the disease. The prevailing sentiment with unfortunate stock-owners has gone far beyond this, — by claiming compensation for animals which had died before they were aware that contagion was present, and for all animals that were sick at the time the municipal officers or commissioners assumed control of the case. Such claims have not been allowed, and our administration of the law has been in accordance with the view above given. The original law in most of its provisions was extremely rigid, and supported by public opinion its execution was only in the line of extermination.

There were several subsequent enactments relating to other less destructive diseases; but the stringent measures of the original act remained, and were necessarily applied to all alike. Our observation of the type and progress of hog cholera in this State, and our experiments in the isolation, disinfection and treatment of the infected animals, early convinced us that the prime object for which the law was framed could be attained (except in rare cases) without slaughtering the animals found apparently healthy at the time the officers took control of the infected herds. Directions were therefore given for strict isolation; to remove all animals from their infected enclosures, to separate the sick from the healthy, to disinfect and feed with acid, and appraise such animals as showed no evidence of being diseased at that time: and if the disease developed in any of the appraised animals causing their death, a bill according to such appraisal, and the expense of appraisal, care and disinfection, would be approved. Many such bills were paid. But a subsequent examination of the strict letter of the law by the approving officers led to the opinion that though the method secured the objects for which the law was framed, and saved a large sum of money to the State and cities and towns, yet the bills were not strictly legal unless the animals were killed; and their further payment was stopped. There are quite a number of such bills now outstanding, and it would be only a measure of common justice to pass an enabling act that they may be paid. Our statutes conferring power for the suppression of contagions among domestic animals have been enacted piecemeal to meet sudden emergencies, that their provisions might be adapted to the peculiarities of different diseases or in compliance with public opinion ; and some of them are not in harmony, others are incongruous or obsolete, and others are too rigid and confer too much power or do not direct it wisely. We recommend that the law in its different provisions be rearranged, modified and made more elastic to meet contingencies liable to occur, and to be in harmony with themselves, believing that its administration will thereby be simplified, made more effective, and the public good promoted.

LEVI STOCKBRIDGE,
A. W. CHEEVER,
J. F. WINCHESTER, D. V. S.,
Cattle Commissioners.

BOSTON, Jan. 7, 1887.

REPORT ON THE HORTICULTURAL SOCIETY FOR 1886.

By James P. Lynde of Athol.

The report of the Hon. J. S. Grinnell upon the Horticultural Society last year was so comprehensive and exhaustive, — covering its history, methods, work and financial standing, — that it is only left for me to review the past year's transactions and consider their influence upon progressive agriculture.

The sum appropriated for premiums was over $6,000, distributed through four exhibitions, held in March, June, September and November, covering a period of three or four days each, to which an admission fee was charged, and through eleven weekly exhibitions, from July 3, which were free to the public.

Thirteen meetings for essays and discussions, free to the public, were held during the winter and spring, at which the following topics were considered: —

Jan. 16. — A Trip to the Tropics, by Joseph H. Woodford of Newton.
Fruits that Promise well, by E. W. Wood of Newton.
Jan. 23. — The Forest Interests of Massachusetts, by William C. Strong of Newton Highlands.
The Most Desirable Varieties of Fruit, by Marshall P. Wilder of Dorchester.
Jan. 30. — Forestry, by Rev. J. B. Harrison of Franklin Falls, N. H.
Feb. 6. — The Gladiolus, by William E. Endicott of Canton.
Feb. 13. — Bulbs and Tubers for Out-door Culture, by Mrs. T. L. Nelson of Worcester.
Feb. 20. — The Food Question, by Edward Atkinson of Boston.

Feb. 27. — Vegetable Growing, by Warren W. Rawson of Arlington.
Mar. 6. — The Progress of Orchid Culture in America, by Edward L. Beard of Cambridge.
Mar. 13. — Horticultural Landscape, by Dr. George A. Bowen of Woodstock, Ct.
Mar. 20. — Care and Embellishment of Cemeteries, by John G. Barker of Lynn.
Mar. 27. — Nitrogen: Why the Crops must have it, and how they must get it, by Prof. G. C. Caldwell of Ithaca, N. Y.
Apr. 3. — The Nomenclature of Fruits.
Apr. 10. — The Ripening and Preservation of Fruits, by Marshall P. Wilder of Dorchester.

This is a brief outline of the year's work. The essays and discussions are embodied in the Society's publications, and are of great value. Vegetables, fruits and flowers are the specialties that receive attention.

The exhibitions are held in the two large halls in the Society's building in Boston, — fruits and vegetables in the lower, and flowers and plants in the upper hall. At the four principal exhibitions the display of flowers and plants completely filled the upper hall, presenting a scene of enchanting beauty, especially in the evening under the mellow radiance of the electric light.

Who can describe a rose, — the queen of flowers, — an orchid, a chrysanthemum, a rainbow, a glorious sunset, or the glittering sapphires and rubies, painted by a morning sunbeam in a drop of dew? The pen of another must record the beauty and perfume of these floral collections. Every specimen was an object-lesson in itself, many of them of great value and of absorbing interest to all beholders. The mystic goddesses of horticulture, Pomona and Flora, held high court, displayed their rich treasures, and received the homage of their votaries.

We have stood before the statue of one we have known, honored and loved: so faithfully had the artist wrought, that the cold, insensate marble seemed instinct with life, and to our imagination the inarticulate lip and eye would almost seem to move in recognition of our presence.

We have looked upon a picture of the great Nazarene.

painted by the hand of an old master with such perfection that the countenance seemed so illumined with an expression of grace, pity and love that we could almost feel the influence of His personal presence, and we have looked and turned away, only to return spell-bound with tender admiration.

Who has not felt the mysterious influences and been moved in the profound depths of consciousness by the "Divine Art" of Mozart, Handel and Beethoven? What an inspiration to deeds of heroic self-sacrifice for real or supposed good! And what a source of comfort, pleasure and happiness to mankind, holding its power through the ages over all races of men!

Can we not properly claim a place as a companion of high art for skilled Horticulture, which, directing the forces of nature, evolves from the lifeless clod objects of utility and beauty, crowned with blessings and delights far excelling in perfection works of sculpture and painting, speaking to human hearts through a silent language as suggestive and uplifting in influence and culture as the finest music? Therefore, is she not entitled to at least honorable mention and high rank among the so-called Fine Arts?

> "Your voiceless lips, O flowers, are living preachers,
> Each cup a pulpit, every leaf a book,
> Supplying to my fancy numerous teachers
> From loneliest nook.
>
> "Were I in churchless solitudes remaining,
> Far from all voice of teachers and divines,
> My soul would find in flowers of God's ordaining
> Priests, sermons, shrines."
>
> — Horace Smith.

The work and influence of this Society is a constant public benefaction, by the introduction of new and improved varieties of vegetables, fruits and flowers, and illustrating the best methods of their cultivation, stimulating the ambition of people to improve and excel in these specialties.

Some one has said that no person could eat of our choicest grapes, apples and pears without being indebted to the genius of Marshall P. Wilder.

The influence of the Society is not confined to this or the New England States. Its members and patrons are, many of them, the most successful cultivators of gardens, fruits and flowers in this country or the world; and wherever horticultural societies have been organized in this or other countries, even in distant Japan, its influence is felt. It was incorporated in 1829, and is the oldest horticultural society in this country. It has steadily increased its membership, enlarged its plans, collected its valuable library, prospered financially, extended its influence and established its reputation in this and other countries as one of the leading horticultural societies in the world. It has outgrown its once ample accommodations and is vexed with the problem of their enlargement.

It was a happy thought that suggested a union of this Society with this Board of Agriculture and the other societies. All will be benefited. We needed its help and influence, perhaps, far more than it needed ours. Let us endeavor to make the relation mutually pleasant and helpful.

Almost at the close of the year we were startled by the sudden death of the Hon. Marshall P. Wilder, at the ripe age of 88. He had been connected with this society fifty-six years, and was more widely known and more prominent than any other member. He was the father of this Board of Agriculture and an active member thereof since its organization in 1851. He was the father of the Agricultural College and one of the trustees for many years and one of its chief benefactors. He was the father of the American Pomological Society and its president since its organization, thirty-eight years ago. He was for twenty years president of the Norfolk Agricultural Society and made honorary president on his retirement. In 1852, he assisted in forming the United States Agricultural Society and was for six years its president.

He was an active or honorary member of many societies at home and abroad. He was distinguished in military, political and Masonic circles, and as a citizen was held in high esteem. He was a man of fine personal presence and bearing, — honest, true to his friends, — a cultivated Christian gentleman.

This Board shares with the Horticultural Society in a deep sense of loss by his removal from the earth, and will cherish his memory with affectionate regard.

He wooed Nature with a passionate love, ministered at her altar, sought for her secrets with which to bless mankind.

" For all his life was poor without!
O, Nature! make the last amends:
Train all thy flowers his grave about
And make thy singing birds his friends

" Revive again, thou summer rain,
The broken turf upon his bed!
Breathe, summer wind, thy tenderest strain
Of low, sweet music overhead!

" With calm and beauty symbolize
His peace, which follows long annoy;
And lend our earth-bent mourning eyes
Some hint of his diviner joy.

" For safe with right and truth he is, —
As God lives he must live alway.
There is no end for souls like his:
No night for children of the day."

— WHITTIER.

[Essay and Discussion at the Chamberlain Club, Worcester, Dec. 9, 1886.]

CORN.

BY PHILANDER S. SEARS.

The common maize, or Indian corn, is generally believed to be a native of the warmer parts of America, where it was cultivated by the aborigines before the discovery of America by Columbus. But the representation of the plant found in an ancient Chinese book in the royal library in Paris, and the alleged discovery of some grains of it in the cellars of ancient houses in Athens, have led some to suppose that it is a native also of the East, and has, from a very early period, been cultivated there, and even that it is the corn of Scripture, although on this supposition it is not easy to account for the subsequent neglect of it until after the discovery of America, since which time the spread of its cultivation in the Old World has taken place with a rapidity such as might be expected from its great productiveness and other valuable qualities.

Columbus himself brought it to Spain about the year 1520. It is now in general cultivation in the south of Europe, and supplies a principal part of the food of the inhabitants of Asia and Africa. It is by far the most productive of all the cereals, in the most favorable localities yielding an increase of eight hundred for one. It succeeds better in a subtropical than in a tropical climate, and being a shortlived annual is cultivated where the heat of summer is intense, no matter what may be the cold of winter. There are few plants of which the uses are more various than the

Indian corn, and few which are of greater importance to man. There are many kinds of corn, but you are all so well acquainted with them that I will not weary your patience by enumerating them. But one kind called Chili maize, or Valparaiso corn, is distinguished by its serrated leaves. It is a smaller plant, a native of Chili, and has won a superstitious regard, because its grains when roasted split in the form of a cross.

MANNER OF CULTIVATION.

It would be folly for me to attempt to tell the members of this club how to raise corn, for each person has some special reason for cultivating it in his own way. But there are some general rules which all are obliged to follow.

First. Apply plenty of fertilizers, for it is a grass feeder and will well repay a liberal application of plant food.

Second. If your land is stubble it will pay well to plow twice; if sod, plow not too deep and harrow thoroughly.

Third. Be sure and have good seed, and to be sure of that it is best to select the ears from the field and trace them up; for if we defer selecting seed until spring it is frequently the case that the corn has been heated and will fail to germinate, as was the case with many the past season.

Fourth. Be sure and keep well cultivated and free from weeds, for one crop is enough at a time, and it does not pay to raise a crop of weeds. I was never so thoroughly convinced of the value of cultivation as I have been the past season. On one part of a field I had not time, during the press of work, to finish hoeing for about ten days. It was so grassy that you could hardly tell where it was hoed and where not; but the part hoed last was always smaller and the difference could be seen from quite a distance, showing conclusively that although we may plow, fertilize, have good feed, and yet if we fail to properly cultivate the land we shall fail to receive the full compensation for our labor.

MANNER OF HARVESTING.

The old-fashioned way of harvesting was, when the corn had become mostly glazed, to cut the stalks above the ear, then stack until cured and leave the corn to ripen. I must say that I think we can get the best and soundest corn in that way, and I know that it makes the best and sweetest bread; but most farmers, at the present time, practise cutting up at the root. The reasons are explained in a quotation from Allen's "American Farm Book": —

> If the stalks are designed for fodder they should be cut when the corn is well glazed, and this should be done in all cases when frost is expected. Scarcely any injury will result either to leaf or grain if the corn be stooked, while both would be seriously damaged from the same exposure if standing.
>
> The stalks of corn should never be cut above the ear but always near the ground, and for this obvious reason, — the sap which nourishes the grain is drawn from the earth, and, passing through the stem, enters the leaf, where a change is effected analogous to what takes place in the blood when brought to the surface of the lungs in the animal system, with this peculiar difference, however, that while the blood gives out carbon and absorbs oxygen, plants under the influence of light and heat give out oxygen and absorb carbon. The change prepares the sap for condensation and conversion into grain. But the leaves which thus digest the food for the grain are above it, for it is while passing downward that the change of the sap into grain principally takes place. If the stalk be cut above the ear, nourishment is at an end. It may then become firm and dry, but it is not increased in quantity; while if cut from the root, it not only appropriates the sap already in the plant, but it also absorbs additional matter from the atmosphere, which contributes to its weight and perfection.

There is no doubt but that the stover is better cut from the root and it is less work; but when it is claimed that the corn is better, I shall disagree. As a forage plant for dairy farmers I think it is of more importance than when raised for the grain; for when we can buy corn at the present prices we can make a specialty of dairying by using corn as the leading plant for a system of soiling in summer, and for a feed for winter it can be cured either by drying or by putting it into a silo. We are thus enabled to keep a large amount of stock on a small area of ground.

DISCUSSION.

From the reports of the members this evening, it appears that 60 bushels shelled corn (or 70 pounds on the ear) per acre may, with a fair amount of fertilization and clean cultivation, be reasonably expected; it also appears that dry stover, if clean and sweet, is at least equal in feed value to the best hay, and that meal made by grinding the whole ears is equal, pound for pound, in feeding value to that produced from Western corn (such as is usually sold by dealers), and further, it is conceded that if at the time of husking the grain is dry enough to crib and the stover to *pack* without danger of heating or mould, the ears and stover are about equal in weight, and as 60 bushels of corn at 70 pounds per bushel weighs 4,200 pounds, or $2\frac{1}{10}$ tons, it follows that the weight of the stover must be the same, making its feeding value at the present price of hay from $35 to $40. If this estimate is correct it can be easily seen that the corn has cost nothing, the members reporting that $35 or $40 will cover the entire cost of the acre, including fertilizer, cultivation and harvesting.

Many careful trials have proven that one bushel (70 pounds) of cobbage meal, together with 70 pounds of stover, is a good and sufficient feed for a milch cow one week; so that one acre of average corn will keep two cows nearly or quite through the entire winter.

Having settled these points, it would seem as though nothing more need be said to induce every dairy farmer who is a member of this club to raise all the corn he uses, thus removing the greatest burden with which we have to contend, — the grain bills. But you say you have not the manure or the money to buy it. Well, that is bad, but it is much easier to raise one dollar for fertilizer than three dollars to pay for the feed which it will produce; if you will try it one year, I think you will be in better condition the year after.

There is one other point, the growing of corn, commonly called fodder or ensilage corn, to be fed green or siloed. From the statements made by members of the club, it appears that the largest yield in this vicinity is 25 tons, just equalling

71 bushels (green weight) of common field corn; the largest yield reported of common field corn is 90 bushels shelled corn, equalling 31 tons green weight, showing an advantage of 6 tons in favor of the latter.

The ensilage corn, at the time of cutting, contains about 13 or 14 per cent. of dry matter, while common field corn contains 20 or 21 per cent., showing an advantage of 6 or 7 per cent. in favor of the latter. The cost of harvesting the fodder corn, if all done at one time, will be about $1 per ton; if drawn daily from the field, much more. The expense of harvesting the field corn I itemize as follows: For 90 bushels, stooking $3, husking $7.20, carting $3, making a total of $11.20, or an advantage of $13.80 in favor of the field corn.

In the case of fodder corn you have only the coarse portion of the feed, the grain must be obtained from some foreign source, while field corn furnishes not only the filling, but also the grain in just the right proportions, pound for pound. Like most new things, the former will not stand the test.

Experience proves that most satisfactory results are obtained from rations made up and fed in the following manner: First in the morning a ration of cut feed, compounded of one or two pounds of coarse butts left by the cattle from a previous feed, cut fine and mixed with five pounds of cobbage meal, the whole having been in soak about 12 hours; in 15 or 20 minutes this will be eaten and the cattle ready for 5 pounds of dry uncut stover, which completes the morning feed; in an hour, or before the cattle are quite done eating, water them, then clean all up and mix the feed for the next meal. Nothing more is needed to be done until 3.30 P. M., then repeat the morning's programme, except the watering, which may be omitted. From the foregoing it will be seen that each animal receives 10 pounds of meal and 10 pounds of stover daily.

From my experience of the last few years, I am satisfied there is much yet to learn in relation to the growing and feeding of this crop.

FRUIT AS A FARM PRODUCT.

By E. W. Wood, of Newton.

Within the memory and practical experience of some of the members of this Board the routine work and general management of the farms in this State required little thought or business ability; the main object of the farmers was to supply as far as possible the family wants from the farm, exchanging whatever surplus products they had for such articles of domestic necessity as they could not or did not produce. But with the immense population, creating a corresponding increase in the demand for farm products, with the establishment of railroads and steamboat lines, furnishing rapid and comparatively cheap means of transportation, extending over a wide area where quickly perishing products may be gathered and concentrated at the centres of consumption, at the same time bringing the Western prairie lands, enriched by centuries of decaying vegetation, in competition with our New England hills, enabling the cultivators of those distant fields to place some of the leading products in our markets at prices that leave a narrow margin of profit to the farmers of this State, — all these changes have rendered necessary on the part of the farmers of the present day a degree of care in the selection of crops and skill in their management, requiring as much thought, care and business ability as is required for the successful management of any mercantile or manufacturing enterprise.

Fruit has not, with few exceptions, been a principal or leading product with the farmers of this State. It has been generally an incidental, though not unfrequently an accidental one. While the cultivation of the small fruits as conducive to the health, comfort and enjoyment of the farmer's family, as an attractive feature increasing the value of every farm, as a source of profit if favorably located as to markets, presents a subject worthy the attention of every farmer, the limits of this occasion will not permit their consideration in detail, and I shall ask your attention mainly to New England's most valuable fruit, the apple.

The apple is becoming every year more exclusively the farmer's crop. The limited grounds in the cities and larger towns will not permit its cultivation, owing to the space required to grow the trees. The area of production is constantly decreasing, while the demand for the fruit in far greater ratio is constantly increasing.

In 1876, the late Colonel Wilder, in an address before the Pomological Society, said, "The foreign market for our fruit is as well established as for our wheat." Yet few farmers in Massachusetts at that time had any practical knowledge of the fact. In that year there were exported three hundred and forty thousand barrels of apples; in some of the years since, the number has reached nearly a million and a half barrels; the number the past season having some weeks exceeded eighty thousand barrels. Formerly an abundant crop was a disadvantage to the growers, as the accumulation of fruit in the dealers' hands forced the market and reduced prices below a paying profit. The past year has been the bearing year for orchards in this vicinity, and there has been an unusually large crop; but there has been no accumulation of fruit among the dealers, and the prices have steadily advanced from the beginning of the season to the present time.

Apples grown in some of the Canadian Provinces, the New England States and the northern portion of the Middle and Western States possess more points of excellence than the same fruit grown in any portion of this country; the more Southern States grow the summer and early autumn varieties in fair quality, but the later varieties are wanting in flavor and the keeping quality, — two essentials requisite for their profitable cultivation.

Massachusetts is near the centre of the apple belt, most favorably situated as regards both the domestic and foreign markets, with Boston as a distributing centre, having steamboat connection with the more Southern ports, affording facilities for meeting the demands of the coastwise trade, and being nearer the foreign markets than any port having equal facilities, and with railroads running through every portion of the State, affording quick and cheap transportation. The difference in the cost of freight transportation, owing to the balance of trade between different points and other causes, is a matter of importance to the farmers. At the present time growers can ship their fruit from Boston to the London market at less cost than those whose orchards are situated within forty miles of that city.

The natural adaptability of our soil and climate to the growth of the apple is shown in the fact that the most desirable varieties have had their origin in this State. The Hubbardston, Baldwin and Roxbury Russet are all natives of Massachusetts, and with a limited number of Gravenstein and Rhode Island Greening are all the varieties needed for an orchard, however extensive. As nearly as can be ascertained, more than four-fifths of all the apples exported are Baldwins, and this, like most fruits, does best near the place of its origin. In some portions of Maine and the Western States, while fully appreciating its many good qualities, they have been obliged to discontinue its cultivation, owing to the frequent loss of the trees during winter. With us it is as hardy as the oak, a strong, vigorous grower, comes early into bearing, and produces abundantly its bright red fruit of good quality, and is excelled in its keeping quality only by the Roxbury Russet.

A mistake most farmers make who grow apples to any extent is in growing too many varieties. With the wholesale dealers a few well-known kinds will sell in large quantities at the highest prices, while a limited quantity having only a local name and reputation will remain unsold or be disposed of at reduced rates.

The land best adapted to apple culture is not the most desirable for ordinary farm products. The rocky hillsides, if not too rough for cultivation, are more desirable than the lower and more level surfaces, the inclination exposing more surface to the light and air, and the fruit being less liable to injury from late frosts in spring, while the rocky formation below the surface furnishes constantly food for the trees, and the feeding fibrous roots will be found clinging to their sides. No crop will make a larger return in proportion to the expense for fertilizers than the apple; it is a biennial crop, the trees taking each alternate year a season of rest. If the land is kept under cultivation, very little outlay for fertilizers will be required to produce fruit of the best quality. In the early years of an orchard, before the trees come into bearing, annual crops may be grown that will pay the cost of cultivation and the fertilizers required, or, what will prove more profitable, in most places any or all of the small fruits may be grown.

If the apple trees are set thirty-five or forty feet apart, rows of peach trees may be set both ways between, making about three times as many of the latter as of the former. It is true the peach has failed in this State almost invariably for the last four years, but it is a crop too valuable, when it is considered how quickly and easily it is grown, to be given up. There is little doubt that the failure of the peach in recent years is owing to the diseased and enfeebled condition of the trees, rather than to any changed condition of soil or climate. So general is disease among the trees, that it is not unusual to see young trees of one year's growth in the nursery rows blighted with the yellows. While growers will gladly welcome any aid from the Experiment Station or elsewhere in the effort to restore health and vigor to the trees already under cultivation, it is an open question whether a more direct remedy does not lie in an effort to get a hardier class of trees through seedling varieties. One grower the past season has competed at every exhibition of the Massachusetts Horticultural Society when prizes were offered for peaches, and at each exhibition showing several dishes, and with one exception they have been seedling fruit. He has a large number of trees of the kinds generally grown which have produced no fruit, while his seedling trees have produced fruit some of which in size and quality compared favorably with our most popular, well-known varieties.

Some twenty years ago there was general alarm among the farmers at the failure of the potato crop for several successive years; the loss amounted to thousands of dollars in this State, but by the introduction of seedling varieties the difficulty was overcome, and there has been little or no complaint in recent years. May we not hope that a second Bresee will give us an Early Rose peach through which the trees may be restored to their pristine vigor, and that we may again grow annually this most productive, most delicious and most valuable fruit.

If peach trees, grape vines, or currant bushes are set with the young apple trees they should produce a paying crop the third year; if blackberries or raspberries, the second year, and if strawberries, the first year. When the apple trees have grown so as to shade the ground, a light ploughing in the spring, followed by the occasional use of the harrow or cultivator, will afford all the necessary cultivation.

First-class market fruit cannot be grown for any considerable time if a close-matted grass turf is allowed to cover the ground above the roots of the trees, unless in exceptionally favorable locations receiving the wash from buildings, yards or highways. The best success and most profitable results can be secured only when the orchard receives the same intelligent care given to other crops in the cultivation of the ground, in the care of the trees, in their protection from injurious insects, and in gathering and marketing the fruit.

All the advantages of location and adaptability of soil and climate claimed for the apple may be urged with equal force for the cultivation of the pear. Nowhere is the pear grown with greater ease, with more certainty of a crop, or in greater perfection, than in this State. The past year the pear crop has been unusually large, yet it has never been disposed of more easily or more satisfactorily to both growers and dealers. Besides the demand for home trade, Maine, portions of Canada, New York and Philadelphia have drawn upon the Boston market for a partial supply of this fruit. The establishment of cold-storage houses has materially aided in marketing this fruit, by extending the time when some of the best varieties may be had in condition for the table from two weeks to six or eight weeks. The Bosc, the Sheldon and the Seckel, early October varieties, may be had in perfection as a dessert with the Thanksgiving dinner. The later varieties, should the supply exceed the demand, might safely be shipped to foreign markets. The pear, under ordinary conditions, produces an annual crop, and requires higher cultivation than the apple to produce the best quality of fruit. The most successful growers for market do not cultivate more than six or seven kinds, and of these at least one-half are the Bartlett and Anjou varieties. As four pear trees can be properly grown upon the space usually allotted to one apple tree, both the product and the profit in the earlier years of the orchard will be greater with the pear than the apple; but later, as the apple trees approach their full growth, the results will be changed, unless the location prove exceptionally favorable for the pear, aided by careful cultivation and liberal fertilization. None of our fruits are so free from insect pests as the pear; but many orchards have suffered more or less from pear blight, which made its appearance in this vicinity about ten years ago, after a lapse of some twenty-five years during which the orchards had been free from this disease. In some localities the loss has been quite severe, though as a whole slight compared with its ravages in the orchards in some of the Western States.

Massachusetts has been considered about the northern limit where the grape could be successfully grown in the open air; and, notwithstanding many failures in the attempts to grow the hybrid crosses of the foreign with our native varieties, grape culture has increased more within the last ten years, especially among farmers, than any other variety of fruit, and the increase has been largely in the northern portion of the State. In some of the towns on the New Hampshire border the farmers, selecting elevated locations with a light, warm soil and southern aspect, have found the grape crop their most profitable farm product. In the larger vineyards the Concord still continues to be largely grown; but the Worden and Moore's Early, supposed to be seedlings from the Concord, and fully equalling if not excelling it in quality, and ripening from one to two weeks earlier, are coming every year into more general cultivation.

The profitable growing of the small fruits by the farmers must depend much upon location. They require more hand labor in their cultivation and in preparing the crop for market; but if near any of the cities or large towns affording a ready market, they may be made an important item on the farmer's balance sheet at the close of the year.

When a number of individuals, either as a firm or an incorporated body, propose to go into any manufacturing enterprise, their first inquiries are, what are the facilities for producing the goods which they propose to make, what are the advantages of location as regards the raw material and markets for the product, what the probable demand and supply, what may reasonably be expected as profit. Tried by these tests, the cultivation of fruit deserves the careful consideration of the farmers of Massachusetts. With many advantages of soil and climate for producing the fruits that enter most largely into general consumption; with every advantage of location as regards both the home demand and foreign markets; with thousands of acres of cheap and at present unproductive land admirably adapted to the cultivation of fruit; with a demand for home consumption constantly increasing, and a foreign market yet in its infancy but susceptible of indefinite extension,—there would seem to be no reason why fruit should not become one of the leading agricultural products of the State.

FOURTH ANNUAL REPORT

OF THE

DIRECTOR OF THE STATE AGRICULTURAL EXPERIMENT STATION AT AMHERST, MASS.

REPORT.

To the Honorable Board of Control.

GENTLEMEN: — The past year has been one of marked activity in the history of the Station. The additional appropriation granted by the Legislature of 1886, for finishing and fitting up the chemical laboratory, has rendered it possible to finish the building, according to the design adopted by the Board, and to provide it with a gas machine, a heating apparatus, and such general appliances as are indispensable to meet the purpose for which it has been erected.

A new building has been added to those already existing for experiments in stock feeding. The structure is of wood; clapboarded outside and sheathed inside; fifty-six feet long, twenty-six feet wide, with posts twelve feet high. It is well lighted and ventilated, and contains six separate stalls for cows and two for horses.

The building for feeding experiments with pigs and sheep has been removed to a more convenient locality for the work carried on under its roof. This change in its position has rendered more compact the entire arrangements for keeping the various kinds of farm live-stock for feeding experiments, and will prove ultimately good economy in various directions.

A covered passage, seven feet wide and thirty feet long, has been built to connect the feed room and its scales for weighing the daily fodder rations, by rails, with the stalls occupied by the animals on trial. The building, originally intended for heating apparatus and engine, has been enlarged nine feet in length and twelve feet in width, to serve in the near future for the management of the milk-setting apparatus.

The dwelling-house occupied by the farmer, as well as the principal barn and the sheds, have been kept in good repair. No alterations of any consequence have been made in these buildings. The contemplated changes are confined to the barn; they are of no particular importance as far as expenses are concerned, and may be attended to whenever circumstances render it advisable.

The entire expenses, arising from the increase and the improvement of farm buildings, have been paid from the regular annual income of the Station.

The work in the field has been on a more extensive scale than in any preceding year, for new lands have been added to those occupied during the past. The grounds assigned to the Station at the beginning of its existence consisted of two fields situated at some distance from each other. One field, about three acres in size, which had been used for a series of years for experiments with fruit, was returned three years ago to the College. The other, which comprises an area of 17.72 acres, has remained ever since under the control of the Station. Upon these grounds are located all buildings and experimental fields described in this and in the three preceding annual reports.

The new lands added during the past season, in consequence of an agreement between the Board of Trustees of the State Agricultural College and the Board of Control of the State Agricultural Experiment Station, consist of twenty acres of unimproved grass land and of about ten acres of wood-land. The entire field is a part of the western slope of a prominent and extended elevation, covered with a dense natural forest growth. The wood-land assigned to the Station stretches along the western termination of the grove; it reaches to the crest of the hill, and has been secured to enable the control of the watershed towards the adjoining lower grounds. Three thousand and eight hundred feet of drain tiles have been laid to improve the growth on the lowlands. Twelve acres of the old grass land have been turned over to renovate the soil during the coming season by drill cultivation of suitable crops. It is proposed, subsequently, to turn the more elevated portion of these lands to account for experiments with fruit trees, and to raise upon the remainder, according to particular location, either general farm crops, or utilize them as permanent meadows.

The area occupied by field experiments upon the old grounds has been considerably enlarged. The number of separate fields has been increased; their outlines have been established with a view to permanency, wherever the soil has attained a desirable uniformity as far as its state of cultivation, as well as the condition and character of its latent resources of plant food are concerned. To secure the latter condition as soon as practicable, one and the same mixture of manurial matter — ground bones and muriate of potash — has been used since the establishment of the Station, whenever a general good state of fertilization was needed in the interest of success. Four distinct fields, each more than once acre in size, have been thus far set off to serve, if necessary, for years, for some definite line of observations. The experimental work carried on in the barn, the field and the laboratory during the past year is described in the subsequent pages under the following headings: —

1. Experiments with milch cows to ascertain the feeding value of corn stover as a substitute for English hay, and that of corn ensilage as compared with beet roots.
2. Analyses of fodder articles with reference to their nutritive value, accompanied by a short exposition of the leading principles recognized as the basis for determining the comparative feeding value of our fodder articles in a rational system of stock feeding.
3. Analyses of some prominent feed stuffs, with reference to the fertilizing constituents they contain.
4. On the best condition of fodder corn for the silo.
5. Fodder corn raised on underdrained and exhausted lands, partly manured with one single article of plant food, partly without the use of any manurial matter.
6. Influence of fertilizers on the quantity and the quality of some prominent crops, — corn and four grasses.
7. Experiments with some prominent fodder crops to furnish a continuous supply of green fodder for dairy stock, — oats, vetch, serradella and Southern pea vines.
8. Experiments with potatoes.
9. Miscellaneous field experiments.
10. Fertilizers and fertilizer analyses; miscellaneous analyses.
11. Well water analyses.
12. Meteorological observations.

It may be noticed from the above statement that some of the reported experiments are continuations of inquiries inaugurated in previous years, while others are the natural outgrowths of preceding investigations; some open new lines of observation.

Considerable attention has been devoted during the past year to constructing buildings, providing a better outfit for the chemical laboratory and for the stock-feeding department. The new year cannot otherwise but materially benefit from the change. The periodical publications of the Station have not been as numerous during the preceding year, on account of temporary interruptions in the work in consequence of delays caused by the erection of new buildings and the remodelling of old ones. The interest in the bulletins and annual reports has been steadily increasing throughout all parts of the State and elsewhere. The printing of bulletins has been increased from three thousand five hundred in 1885, to five thousand copies each in 1886. The second annual report is entirely out of print, and but few of the first and third reports are still at our disposal. None of the bulletins, Nos. 1 to 16, are on hand; the same is the case with No. 20 of the last year. The publication will be resumed at an early date.

The support received from all parties connected with the work of the Station has been very satisfactory.

Permit me to thank you sincerely for the hearty encouragement and the kind support I have enjoyed in carrying on the work assigned to me.

Yours very respectfully,

C. A. GOESSMANN,

Director of the State Agricultural Experiment Station.

FEEDING EXPERIMENTS.

C. A. GOESSMANN.

1. Experiments with Milch Cows.

The feeding experiments described within a few subsequent pages were chiefly instituted for the purpose of studying the feeding value of dried corn fodder (stover) as a substitute for English hay, and of beet roots as compared with corn ensilage. The observations made in this connection extended over a period of nearly eight months, — November, 1885, to July, 1886.

Two cows, crosses of native stock and Ayrshires, and both from six to seven years old, served for the trial. They were in the same milking period, four weeks after calving, at the beginning of the experiments. The changes in diet, whenever decided upon, were made gradual, to prevent any serious disturbance in the general condition of the animal on trial. As a rule, from four to five or more days were allowed to pass by, in case of a change of food, before a record of the daily yield of milk was made for the purpose of comparing the effect of different fodder rations.

The valuation of the various fodder articles consumed is based on our local market prices, per ton, at the time of their use: Good English hay, $15; corn meal, $23; wheat bran, $20; dry corn fodder (stover), $5; corn ensilage, $2.75; Lane's Improved Sugar Beet, $5.

The daily diet of both cows consisted at the beginning of the experiments of three and one-quarter pounds of corn meal, an equal weight of wheat bran and all the hay they would eat.

The actual amount of hay consumed, in each case, was ascertained by weighing out daily a liberal supply of it and deducting subsequently the hay left over. The same fodder mixture, as far as quality and quantity are concerned, was also used for some time as daily feed at the close of the experiment. This course was adopted for the purpose of ascertaining the natural shrinkage in daily yield of milk during the time engaged by the experiments (from seven to eight months). It amounted, as may be noticed in the subsequent detailed record, to nearly 50 per cent. of the original yield of milk.

The above-stated combination of fodder articles was adopted as the basis of our investigation, mainly for the reason that it had been used with satisfactory results in some of our earlier feeding experiments, and not on the assumption of its being the best possible combination of fodder articles for milch cows.

The value of a fodder for dairy purposes may be stated from two distinctly different standpoints, — namely, with reference to its influence on the temporary yield of milk, and the general condition of the animals which consume it; and in regard to its first cost, *i. e.*, its physiological and commercial value.

The market price of our fodder articles depends on the supply and demand in the general market; its determination is beyond the control of the individual farmer. The market price of hay of the same quality may vary widely in different years and in different localities; its feeding value remains materially the same, under corresponding circumstances, year after year.

The market value and actual feeding effect of one and the same article do not necessarily correspond with each other; in fact, they rarely coincide.

The market value may be stated for each locality by one definite number. *The feeding effect* of one and the same substance, simple or compound, varies under different circumstances, and depends in a controlling degree on its judicious use. Sugar fed without any suitable admixture has no feeding value; it is worthless as the sole food of an animal. Properly supplemented, — as, for instance, in the sweet corn, — its nutritive value is very great. Bread has a high feeding value for man; a cat fed exclusively with bread dies, after some weeks, with the symptoms of starvation.

As no single plant or part of plants has been found to supply economically and efficiently to any considerable extent the wants of our various kinds of farm stock, it becomes a matter of first importance to learn how to *supplement* our leading farm crops, to meet the divers wants of each kind. To secure the highest feeding value of each article of fodder is most desirable in the interest of good economy. The judicious selection of ingredients for a suitable and remunerative diet for our dairy stock obliges us, therefore, to study the value of the fodder articles at our disposal from both standpoints.

The chemical analyses of the various articles used in the combination of fodder in our case are stated in some succeeding pages, to show their character and their respective quality. To ascertain the chemical composition of a fodder ration in connection with an otherwise carefully managed feeding experiment, enables us to recognize, with more certainty, the causes of the varying feeding effects of one and the same fodder article, when fed in different combinations. It furnishes also a most valuable guide in the selection of suitable commercial feed stuffs from *known sources* to supplement economically our home-raised fodder crops. Practical experience in feeding stock has so far advanced, that it seems to need no further argument to accept it as a matter of fact, that the efficiency of a fodder ration in the dairy does not depend on the mere presence of more or less of certain prominent fodder articles, but on the presence of a proper quantity and a certain relative proportion of some prominent constituents of plants, which are known to be essential for a successful support of life and the special functions of the dairy cow.

Investigations into the relations which the various prominent constituents of plants bear to the support of animal life, have rendered it advisable to classify them in this connection into three groups, — mineral constituents, and nitrogenous and non-nitrogenous organic constituents. For details regarding this matter I have to refer to previous publications of the Station. Numerous and extensive practical feeding experiments, with most of our prominent fodder articles in various conditions, and with all kinds of farm live stock, have introduced the practice of reporting together with analysis of the chemist, the results of careful feeding experiments, as far as the various fodder articles have proved digestible, and were thus qualified for the support of the life and the functions of the particular kind of animal on trial. In stating the amount of the digestible portion of the fodder consumed in a feeding experiment, it has also proved useful for comparing different fodder rations, etc., to make known by a distinct record the relative proportion which has been noticed to exist between the amount of nitrogenous constituents and the non-nitrogenous organic constituents. This relation is expressed by the name of "Nutritive Ratio." An examination of the subsequent short description of our feeding experiments will show, for instance, that the corn meal we fed contained one part of digestible nitrogenous matter, to 8.76 parts of digestible non-nitrogenous organic matter, making the customary allowance for the higher physiological value of the fat as compared with that of starch, sugar, etc. (2.5 times higher). The "Nutritive Ratio" of the corn meal is subsequently stated as follows, — 1 : 8.76. Our different combinations of fodder articles, to constitute the daily diet during different feeding periods, vary as far as their nutritive ratios are concerned from 1 : 6.7 to 1 : 10.17. The closer relation (1 : 6.7) was obtained by an exceptionally large amount of roots, with hay and wheat bran without corn meal; and the wider relation (1 : 10.17), by feeding a liberal amount of corn ensilage with hay and corn meal without bran. A closer relation of nitrogenous and non-nitrogenous digestible constituents of an otherwise suitable fodder mixture is considered more necessary for growing animals and dairy cows, than for full-grown animals and moderately worked horses and oxen. German investigators recommend for dairy cows a diet which conforms to a nutritive ratio of 1 : 5.4. Arrangements will be made during the coming winter season to repeat our feeding experiments with essentially the same coarse fodder articles, but modified by a suitable increase and addition of concentrated feed stuffs to secure daily diet of a closer nutritive ratio, than has been used on the present occasion.

An examination of the subsequent tabulated statement of the results of our experiments shows, among other interesting facts, the marked influence of the feeding of dried corn fodder and of corn ensilage as a substitute for a part of the English hay, on the cost of the production of milk. Not less striking is the beneficial influence of a moderate amount of roots, as a substitute for a part of the hay, on the quality of milk. A numerical expression of the influence of the yield of milk in case of different cows, as well as at different milking periods of the same cow under the same system of feeding, on the cost of its production, may not be without some interest, when entering upon a serious discussion of the question, What kind of cows ought to be removed from our dairy stock in the interest of good economy?

RECORD OF DAISY.

FEEDING PERIODS.	FEED CONSUMED (LBS.) PER DAY.						Amount of dry vegetable matter contained in the daily fodder consumed (In pounds).	Quarts of milk produced per day.	Pounds of dry matter per quart of milk.	Nutritive Ratio.	Weight of Animal.
	Wheat Shorts.	Corn Meal.	Corn Fodder.	Hay.	Ensilage.	Roots.					
1885. Nov. 20 to Dec. 7,	3.25	3.25	-	20.00	-	-	24.06	16.3	1.48	1: 8.2	910
Dec. 19 to 29, .	3.25	3.25	8.00	10.00	-	-	21.64	15.4	1.45	1: 7.9	895
1886. Jan. 3 to 22, .	3.25	3.25	12.00	5.00	-	-	20.44	14.2	1.44	1: 7.72	850
Feb. 1 to 17, .	3.25	3.25	-	15.00	-	27.00	23 91	14.2	1.68	1: 7.1	845
" 20 to 28, .	3.25	-	-	15.00	-	27.00	21.06	13.2	1.60	1: 6.9	850
Mar. 1 to 8, .	3.25	-	-	15.00	-	40.00	23.18	13.3	1.74	1: 6.7	873
" 12 to 22, .	3.25	3.25	-	15.00	-	27.00	23.89	14.2	1.68	1: 7.1	860
" 25 to Apr.13,	3.25	3.25	-	14.60	20 63	-	23.73	12.8	1.85	1: 8.14	870
Apr. 18 to May 6,	3.25	3 25	-	10.00	29.71	-	21.51	11.0	1.91	1: 8.15	865
May 20 to 31, .	-	3.25	-	5 00	41.75	-	16.83	9.2	1.83	1:10.17	830
June 4 to 14, .	3.25	-	-	5.00	41 36	-	16.76	8 9	1 88	1: 8.29	855
" 26 to July 4,	3.25	3 25	-	20.00	-	-	24.04	8.4	2.86	1: 8.2	840

RECORD OF MOLLIE.

FEEDING PERIODS.	FEED CONSUMED (LBS.) PER DAY.						Amount of dry vegetable matter contained in the daily fodder consumed (in pounds).	Quarts of milk produced per day.	Pounds of dry matter per quart of milk.	Nutritive Ratio.	Weight of Animal.
	Wheat Shorts.	Corn Meal.	Corn Fodder.	Hay.	Ensilage.	Roots.					
1885. Nov. 20 to Dec. 7,	3.25	3 25	-	20.00	-	-	24.06	12.62	1.93	1: 8.2	882
Dec. 19 to 29, .	3.25	3.25	8.00	10 00	-	-	21.64	11.86	1.82	1: 7.9	885
1886. Jan. 3 to 22, .	3 25	3.25	13.35	5.00	-	-	21.75	13.87	1.56	1: 7.87	845
Feb. 1 to 17, .	3.25	3.25	-	15.00	-	27.00	23.91	11 16	2.14	1: 7.1	868
" 17 to 28, .	3.25	-	-	15.00	-	27.00	21.06	13 2	1.60	1: 6.9	910
Mar. 1 to 8, .	3.25	-	-	15.00	-	40.00	23.18	10.06	2.19	1: 6.7	895
" 12 to 22, .	3.25	3.25	-	15.00	-	27.00	23.89	11.1	2.15	1: 7.1	906
" 25 to Apr. 13,	3.25	3.25	-	14.20	22.27	-	23.74	11.2	2.12	1: 8.17	921
Apr. 18 to May 6,	3.25	3.25	-	10.00	29.82	-	21.58	10.6	2.04	1: 8.15	899
May 20 to 31, .	-	3.25	-	5.00	36.83	-	16.64	8.9	1.87	1: 0.09	850
June 4 to 14, .	3.25	-	-	5.00	40.63	-	16.59	9.1	1.82	1: 8.25	852
" 26 to July 4,	3.25	3.25	-	20 00	-	-	24 04	8.6	2.80	1: 8.2	830

Cost of Feed per Quart of Milk.

(DAISY.)

FEEDING PERIODS.	Total Quantity of Milk Produced during Entire Period.	Average Daily Yield of Milk for Period.	Total Amount of Shorts Consumed during Period.	Total Amount of Corn Meal Consumed during Period.	Total Amount of Corn Fodder Consumed during Period.	Total Amount of Hay Consumed during Period.	Total Amount of Ensilage Consumed during Period.	Total Amount of Roots Consumed during Period.	Total Cost of Fodder Consumed during Period.	Average Cost of Feed for Production of One Quart of Milk for Period.
	Qts.	*Qts.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*		*Cents.*
Nov. 20 to Dec. 7,	292.5	16.3	58.50	58 50	-	360.00	-	-	$3.96	1.35
Dec. 19 to 29, .	169.0	15.4	35.75	35.75	88 00	110.00	-	-	1.81	1.07
Jan. 3 to 22, .	283.5	14.2	65.00	65.00	240.00	100.00	-	-	2.75	0.97
Feb. 1 to 17, .	241.5	14.2	55.25	55.25	-	255.00	-	459.06	4.25	1.76
" 20 to 28, .	118.5	13.2	29.25	-	-	135.00	-	243.00	1.91	1.61
Mar. 1 to 8, .	106.5	13.3	26.00	-	-	120.00	-	320.00	1.96	1.84
" 12 to 22, .	156.5	14.2	35.75	35.75	-	165.00	-	297.00	2.75	1.76
" 25 to Apr. 13,	256.2	12 8	65.00	65 00	-	292.00	412.50	-	4.12	1.61
Apr. 18 to May 6,	209.5	11.6	61.75	61.75	-	190.00	564.50	-	3.49	1.67
May 20 to 31, .	112.7	9.2	-	39.00	-	60.00	501.00	-	1.55	1.37
June 4 to 14, .	98.0	8.9	35.75	-	-	55.00	455.00	-	1.36	1.39
" 26 to July 4,	75.5	8.4	29.25	29.25	-	180.00	-	-	1.99	2.64

Cost of Feed per Quart of Milk.

(MOLLIE.)

FEEDING PERIODS.	Total Quantity of Milk Produced during Entire Period.	Average Daily Yield of Milk for Period.	Total Amount of Shorts Consumed during Period.	Total Amount of Corn Meal Consumed during Period.	Total Amount of Fodder Corn Consumed during Period.	Total Amount of Hay Consumed during Period.	Total Amount of Ensilage Consumed during Period.	Total Amount of Roots Consumed during Period.	Total Cost of Fodder Consumed during Period.	Average Cost of Feed for Production of One Quart of Milk for Period.
	Qts.	*Qts.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*		*Cents.*
Nov. 20 to Dec. 7,	227.5	12.6	58.50	58.50	–	360.00	–	–	$3.96	1.74
Dec. 19 to 29, .	130.5	11.9	35.75	35.75	88.00	110.00	–	–	1.81	1.39
Jan. 3 to 22, .	277.5	13.9	65.00	65.00	271.00	100.00	–	–	2.82	1.02
Feb. 1 to 17, .	189.8	11.2	55.25	55.25	–	255.00	–	459 00	4.25	2.24
" 20 to 28, .	96.0	10.6	29.25	–	–	135 00	–	243.00	1.91	1.99
Mar. 1 to 8, .	84.5	10.6	26.00	–	–	120.00	–	320.00	1.96	2.32
" 12 to 22, .	122.0	11.1	35.75	35.75	–	165.00	–	297.00	2.75	2.25
" 25 to Apr. 13,	223.5	11.2	65.00	65.00	–	284.00	445.50	–	4.11	1.84
Apr. 18 to May 6,	190.3	10.0	61.75	61.75	–	190 00	566.50	–	3.49	1.83
May 20 to 31, .	107.0	8.9	–	39.00	–	60.00	442.00	–	1.47	1.37
June 4 to 14, .	100.5	9.1	35.75	–	–	55.00	447.00	–	1.35	1.33
" 26 to July 4,	77.0	8.6	29.25	29.25	–	180.00	–	–	1.99	2.51

Analyses of Milk.

(DAISY.)

	1885. Nov. 25.	Dec. 15.	1886. Jan. 6.	Feb. 18.	Feb 25.	Mar. 4.	Mar. 18.	April 19.	May 14.	May 29.	June 15.	June 21.
Water, . .	87.56	87.65	88.08	86.18	86.62	86.78	85.81	85.97	87.02	87.10	86.75	87.59
Solids, . .	12.44	12 35	11.92	13 82	13.38	13.22	14.19	14.03	12.98	12.90	13.25	12.41
Fat (in solids), .	3.28	3.56	2 29	4.58	4.30	4.30	4.54	4.93	4.05	4.20	4.62	3 79

(MOLLIE.)

	1885. Nov. 25.	Dec. 15.	1886. Jan. 6.	Feb. 18.	Feb. 25.	Mar. 4.	Mar. 18.	April 19	May 14.	May 29.	June 15.	June 21.
Water, . .	87.16	87.35	87.67	86.35	87.04	87.06	86.61	86.33	87 30	87.25	86.50	87.26
Solids, . .	12.84	12.65	12.33	13.65	12.96	13.94	13.39	13.67	12.70	12.75	13.50	12.74
Fat (in solids), .	3.82	3.59	3.73	4.28	3.74	4.75	4.03	4.51	3.96	4.24	4.36	3 68

ANALYSES OF THE DIFFERENT ARTICLES OF FEED CONSUMED DURING THE ABOVE EXPERIMENTS.

HAY.

[From Experiment Station, 1885.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . .	8.30	166.00	–	–	1 : 9.5
Dry Matter, ...	91.70	1,834.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash, ...	6.12	122.40	–	–	
" Cellulose, . . .	30.19	603.80	350.20	58	
" Fat, ...	2.55	51.00	23.46	46	
" Protein (Nitrogenous Matter), . . .	9.75	195.00	111.15	57	
Non-nitrogenous Extract Matter, ...	51.39	102.78	647.51	63	
	100.00	2,000.00	1,132.32	–	

The hay consisted largely of Herd's-grass (*Phleum pratense*) and Red-top (*Agrostis vulgaris*), with a fair admixture of clover.

CORN FODDER.

[From the Experiment Station, 1885.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Mositure at 100° C., . .	15.40	308.00	–	–	1 : 9.3
Dry Matter, ...	84.60	1,692.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash, ...	4.22	84.40	–	–	
" Cellulose, . . .	20.93	418.60	301.39	72	
" Fat, ...	2.63	52.60	39.45	75	
" Protein (Nitrogenous Matter), . . .	9.17	183.40	133.88	73	
Non-nitrogenous Extract Matter, ...	63.05	1,261.00	844 87	67	
	100.00	2,000.00	1,319.59	–	

The above corn fodder was raised under the same conditions, as far as the soil and the fertilizers used are concerned, as the corn for the silos.

CORN ENSILAGE.

[From the Silos of the Experiment Station.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . .	77.48	1,549.60	-	-	1 : 11.3
Dry Matter, ...	22.52	450.40	-	-	
	100.00	2,000.00	-	-	
Analysis of Dry Matter.					
Crude Ash, ...	4.19	83.80	-	-	
" Cellulose, . . .	19.08	381.60	274.68	72	
" Fat, ...	3.49	69.80	52.42	75	
" Protein (Nitrogenous Matter), . . .	7.82	156.40	114.17	73	
Non-nitrogenous Extract Matter, ...	65.42	1,308.40	876.63	67	
	100.00	2,000.00	1,317.90	-	

The above analysis represents the mean composition of the ensilage obtained from the silos described in a previous bulletin. The contents of the silos were fed in direct succession, beginning with the silo which had been filled slowly. The corn had been about six months in the silo when the feeding of the ensilage commenced.

CORN MEAL.

[Amherst Mill, 1885.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . .	12.62	252.40	-	-	1 : 8.76
Dry Matter, ...	87.38	1,747.60	-	-	
	100.00	2,000.00	-	-	
Analysis of Dry Matter.					
Crude Ash, ...	1.56	31.20	-	-	
" Cellulose, . . .	2.66	53.20	18.09	34	
" Fat, ...	4.27	85.40	64.90	76	
" Protein (Nitrogenous Matter), . . .	11.43	228.60	194.31	85	
Non-nitrogenous Extract Matter, ...	80.08	1,601.60	1,505.50	94	
	100.00	2,000.00	1,782.80	-	

The average composition of the corn meal during the experiments.

WHEAT BRAN.

[Amherst Mill, 1885.]

81.93 per cent. passed through Mesh 144 to the square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	12.05	241.00	–	–	1 : 3.77
Dry Matter,	87.95	1,759.00	–	–	
	100 00	2,000.00	–	–	
Anylasis of Dry Matter.					
Crude Ash,	6.64	132.80	–	–	
" Cellulose,	11.49	229.80	45.96	20	
" Fat,	4.75	95.00	76.00	80	
" Protein (Nitrogenous Matter),	17.86	357.20	314.34	88	
Non-nitrogenous Extract Matter,	59.26	1,185.20	948.16	80	
	100.00	2,000.00	1,384.46	–	

The average composition of the wheat bran during the experiments.

LANE'S IMPROVED SUGAR BEET.

[From Experiment Station, 1885.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	83.57	1,671.4	–	–	1 : 5.86
Dry Matter,	16.43	328.6	–	–	
	100.00	2,000.0	–	–	
Analysis of Dry Matter.					
Crude Ash,	3.57	71.4	–	–	
" Cellulose,	5.27	105.4	105.4	100	
" Fat,	.83	16.6	16.6	100	
" Protein (Nitrogenous Matter),	17.44	348.8	261.6	75	
Non-nitrogenous Extract Matter,	72.89	1,457.8	1,384.9	95	
	100.00	2,000.0	1,768.5	–	

Summary of Amount of Digestible Matter contained in the previously described Feeding Periods.

PERIODS.	Total Amount of Food Consumed (in lbs.) during the Entire Period.	Total Amount of Dry Matter Consumed (in lbs.) during the Entire Period.	Digestible Portion of Dry Matter (in lbs.) Consumed during the Entire Period.*	Amount of Digestible Matter Consumed per Day (in lbs.).	Nutritive Ratio.
I., Daisy and Mollie, .	477.00	433.00	267.40	14.86	1 : 8.2
II., " " " .	269.50	238.03	158.40	14.40	1 : 7.9
III., Daisy, . .	470.00	408.71	276.10	13.81	1 : 7.77
III., Mollie, . .	501.00	434.94	293.20	14.66	1 : 7.87
IV., Daisy and Mollie,	824.50	406.40	275.80	16.22	1 : 7.1
V., " " " .	407 25	189.50	123.20	13.69	1 : 6.9
VI., " " " .	466.00	185.40	124.60	15.58	1 : 6.7
VII., " " " .	533.50	262.80	178.30	16.21	1 : 7.1
VIII., Daisy, . .	834.50	474.63	303.00	15.15	1 : 8.14
VIII., Mollie, . .	859.50	474 73	303.70	15.19	1 : 8.17
IX., Daisy, . .	878.00	408.63	267.20	14.06	1 : 8.15
IX., Mollie, . .	880.00	410.08	268.20	14.12	1 : 8.15
X., Daisy, . . .	600.00	201.93	135.90	11.33	1 :10.17
X., Mollie, . . .	541.00	199.64	133.90	11.15	1 :10.09
XI., Daisy, . .	545.75	184.35	118.70	10.79	1 : 8.29
XI., Mollie, . .	537.75	182.54	117.40	10.67	1 : 8.25
XII., Daisy and Mollie,	238.50	216.40	136.00	15.11	1 : 8.0

* The salines contained in these crops are not included.

I. PERIOD (18 DAYS).

Daisy and Mollie.

	Total Amount.	Dry Matter.	Digestible Portion.			
			Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Shorts, ...	58.5	51.5	1.2	2.0	8.1	24.4
Meal, ...	58.5	51.4	.5	1.7	5.0	38.7
Hay, ...	360.	330.1	57.8	3.9	17.2	106.9
	477.0	433.0	59.5	7.6	30.3	170.0

Nutritive ratio, 1 : 8.2.

	Daisy.	Mollie.
Amount of dry matter consumed per day, in lbs., . .	24.06	24.06
Quarts of milk produced per day, ...	16.25	12.62

II. PERIOD (11 DAYS).

Daisy and Mollie.

	Total Amount.	Dry Matter.	Digestible Portion.			
			Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Shorts, ...	35.75	31.44	.7	1.2	4.9	14.9
Meal, ...	35.75	31.27	2.8	1.0	3.1	23.5
Hay, ...	110.00	100.87	17.7	1.2	5.6	32.7
Corn, ...	88.00	74.45	11.2	1.5	5.0	31.4
	269.50	238.03	32.4	4.9	18.6	102.5

Nutritive ratio, 1 : 7.9.

	Daisy.	Mollie
Amount of dry matter consumed per day, in lbs., . .	21.63	21.63
Quarts of milk produced per day, ...	15.36	11.86

III. PERIOD (20 DAYS).

Daisy.

	Total Amount.	Dry Matter.	DIGESTIBLE PORTION.			
			Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Meal, ...	65.00	56.80	.5	1.8	5.5	42.8
Shorts, ...	65.00	57.17	1.3	2.2	9.0	27.1
Hay, ...	100.00	91.70	16.0	1.1	5.1	29.7
Corn, ...	240.00	203.04	30.6	4.0	13.6	85.8
	470.00	408.71	48.40	9.1	33 2	185.4

Mollie.

	Total Amount.	Dry Matter.	Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
Meal, ...	65.00	56.80	.5	1.8	5.5	42.8
Shorts, ...	65.00	57.17	1.3	2.2	9.0	27.1
Hay, ...	100.00	91.70	16.0	1.1	5.1	29.7
Corn, ...	271.00	229.27	34.5	4.5	15.3	96.8
	501.00	434.94	52.3	9.6	34.9	196.4

	Daisy.	Mollie.
Nutritive ratio, ...	1 : 7.72	1 : 7.87
Amount of dry matter consumed per day, in lbs., . .	20.43	21.74
Quarts of milk produced per day, ...	14.17	13.8

IV. PERIOD (17 Days).

Daisy and Mollie.

	Total Amount.	Dry Matter.	Digestible Portion.			
			Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Meal,	55.25	48.60	.4	1.6	4.7	36.6
Shorts,	55.25	48.59	1.1	1.8	7.6	23.0
Hay,	255.00	233.84	40.9	2.7	13.0	75.7
Roots,	459.00	75.41	4.0	.6	9.9	52.2
	824.50	406.4	46.4	6.7	35.2	187.5

Nutritive ratio, 1 : 7.1.

	Daisy.	Mollie.
Amount of dry matter consumed per day, in lbs.,	23.90	23.90
Quarts of milk produced per day,	14 2	11.16

V. PERIOD (9 Days).

Mollie and Daisy.

	Total Amount.	Dry Matter.	Digestible Portion.			
			Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Shorts,	29 25	25.73	.6	1.0	4.0	12.2
Hay,	135.00	123.80	21.7	1.5	6.9	40.1
Roots,	243.00	39.92	2.1	.3	5.2	27.6
	407.25	189.5	24.4	2.8	16 1	79.9

Nutritive ratio, 1 : 6.9.

	Daisy.	Mollie
Amount of dry matter consumed per day, in lbs.,	21.05	21 05
Quarts of milk produced per day,	10.61	13.16

VI. PERIOD (8 DAYS).

Daisy and Mollie.

	Total Amount.	Dry Matter.	Digestible Portion.			
			Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Hay, ...	120.00	110.04	19.3	1.3	6.1	35.6
Shorts, ...	26 00	22.87	.5	.9	3.6	10.8
Roots, ...	320.00	52.58	2.8	.4	6.9	36.4
	466.00	185.44	22.6	2.6	16.6	82.8

Nutritive ratio, 1 : 6.7.

	Daisy.	Mollie.
Amount of dry matter consumed per day, in lbs., . . .	23.17	23.17
Quarts of milk produced per day, ...	13.31	10.56

VII. PERIOD (11 DAYS).

Daisy and Mollie.

	Total Amount.	Dry Matter.	Digestible Portion.			
			Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Meal, ...	35.75	31.24	.28	1.0	3.0	23.5
Hay, ...	165.00	151.31	26.5	1.8	8.4	49.0
Shorts, ...	35.75	31.44	.7	1.2	4.9	14.9
Roots, ...	297.00	48.80	2.57	.4	6.4	33.8
	533.50	262.8	30.0	4.4	22.7	121.2

Nutritive ratio, 1 : 7.1.

	Daisy.	Mollie.
Amount of dry matter consumed per day, in lbs., . . .	23.89	23.89
Quarts of milk produced per day, ...	14.22	11.09

VIII. PERIOD (20 DAYS).

Daisy.

	Total Amount.	Dry Matter.	Digestible Portion.			
			Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Meal, ...	65.00	56.80	.5	1.8	5.5	42.8
Shorts, ...	65.00	57.17	1.3	2.2	9.0	27.1
Hay, ...	292.00	267.76	46.9	3.1	14.9	86.7
Ensilage, . . .	412.50	92.90	12.8	2.4	5.3	40.7
	834.50	474.63	61.5	9.5	34.7	197.3

Mollie.

	Total Amount.	Dry Matter.	Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
Meal, ...	65.00	56.80	.5	1.8	5.5	42.8
Shorts, ...	65.00	57.17	1.3	2.2	9.0	27.1
Hay, ...	284.00	260.43	45.6	3.1	14.5	84.3
Ensilage, . . .	445.50	100.33	13.8	2.6	5.7	44.0
	859.50	474.73	61.2	9.7	34.7	198.1

	Daisy.	Mollie.
Nutritive ratio, ...	1 : 8.14	1 : 8.17
Amount of dry matter consumed per day, in lbs., .	23.73	23.73
Quarts of milk produced per day, ...	12.8	11.2

IX. PERIOD (19 DAYS).

Daisy.

	Total Amount.	Dry Matter.	Digestible Portion.			
			Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Meal, ...	61.75	53.96	.5	1.7	5.3	40.5
Shorts, ...	61.75	54.31	1.2	2.1	8.5	25.7
Hay, ...	190.00	174.23	30.5	2.0	9.7	56.4
Ensilage, . . .	564.30	126.13	17.3	3.3	7.2	55.3
	878.00	408.63	49.5	9.1	30.7	177.9

Mollie.

	Total Amount.	Dry Matter.	Digestible Portion.			
			Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Meal, ...	61.75	53.96	.5	1.7	5.3	40.5
Shorts, ...	61.75	54.31	1.2	2.1	8.5	25.7
Hay, ...	190.00	174.23	30.5	2.0	9.7	56.4
Ensilage, ...	566.50	127.58	17.5	3.3	7.3	56.0
	880.00	410.08	49.7	9.1	30.8	178.6

	Daisy.	Mollie.
Nutritive ratio, ...	1 : 8.15	1 : 8.15
Amount of dry matter consumed per day, in lbs., .	21.51	21.58
Quarts of milk produced per day, ...	11.0	10.6

X. PERIOD (12 DAYS).

Daisy.

	Total Amount.	Dry Matter.	Digestible Portion.			
			Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Meal, ...	39.00	34.08	.3	1.1	3.3	25.7
Hay, ...	60.00	55.02	9.6	.6	3.1	17.8
Ensilage, ...	501.00	112.83	15.5	3.0	6.4	49.5
	600.00	201.93	25.4	4.7	12.8	93.0

Mollie.

Meal, ...	39.00	34.08	.3	1.1	3.3	25.7
Hay, ...	60.00	55.02	9.6	.6	3.1	17.8
Ensilage, ...	442.00	110.54	15.1	2.9	6.3	48.1
	541.00	199.64	25.0	4.6	12.7	91.6

	Daisy.	Mollie.
Nutritive ratio, ...	1 : 10.17	1 : 10.09
Amount of dry matter consumed per day, in lbs., .	16.82	16.63
Quarts of milk produced per day, ...	9.2	8.9

XI. PERIOD (11 DAYS).

Daisy.

	Total Amount.	Dry Matter.	Digestible portion.			
			Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Shorts, ...	35.75	31.44	.7	1.2	4.9	15.9
Hay, ...	55.00	50.44.	8.8	.6	2.8	16.3
Ensilage, . . .	455.00	102.47	14.1	2.7	5.8	44.9
	545.75	184.35	23.6	4.5	13.5	77.1

Mollie.

	Total Amount.	Dry Matter.	Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
Shorts, ...	35 75	31.44	.7	1.2	4.9	15.9
Hay, ...	55.00	50.44	8.8	.6	2.8	16.3
Ensilage, . . .	447.00	100.66	13.8	2.6	5.7	44.1
	537.75	182.54	23.3	4.4	13.4	76.3

	Daisy.	Mollie.
Nutritive ratio, ...	1 : 8.29	1 : 8.25
Amount of dry matter consumed per day, in lbs., .	16.76	16.59
Quarts of milk produced per day, ...	8.9	9.1

XII. PERIOD (9 DAYS).

Daisy and Mollie.

	Total Amount.	Dry Matter.	Digestible Portion.			
			Cellulose.	Fat.	Protein.	Non-nitrogenous Extract Matter.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Meal, ...	29.25	25.56	2.3	.8	2.5	19.2
Shorts, ...	29.25	25.73	.6	1.0	4.0	12.2
Hay, ...	180.00	165.06	28.9	1.9	9.2	53.4
	238.50	216.4	31.8	3.7	15.7	84.8

Nutritive ratio, 1 : 8.

	Daisy.	Mollie.
Amount of dry matter consumed per day, in lbs., . .	24.04	24.04
Quantity of milk produced per day, ...	8.4	8.6

Milk and Creamery Record from November 17, 1885, to April 30, 1886.

	Quarts of Milk Produced.	Spaces of Cream from Milk.	Price allowed per Space.	Am't received from Creamery.
1885.				
November 17 to 30, . .	764	348	4 cts.	$13.92
December 1 to 31, . .	862	409	4 "	16.36
1886.				
January 1 to 31, . . .	785	355	4 "	14.20
February 1 to 28, . . .	695	324	4 "	12.96
March 1 to 31, . . .	772	339	4 "	13.56
April 1 to 30, . . .	688	257	4 "	10.28
	4,566	2,032	–	$81.28

November, 1885.	6.38 spaces of cream made 1 lb. butter, equal to 25.52 cents per pound
December, "	6.50 spaces of cream made 1 lb. butter, equal to 26 cents per pound.
January, 1886.	6.54 spaces of cream made 1 lb. butter, equal to 26.16 cents per pound.
February, "	6.65 spaces of cream made 1 lb. butter, equal to 26.60 cents per pound.
March, "	6.34 spaces of cream made 1 lb. butter, equal to 25.36 cents per pound.
April, "	6.13 spaces of cream made 1 lb. butter, equal to 24.52 cents per pound.

MILK ANALYSIS.

[Samples sent on for Examination.]

	1	2	3	4
Specific gravity, .	1.0375	1.032	1.0329	1.0296
Temperature, C., .	19.°	20.°	17.5°	.23°
Solids, . . .	10.25 per ct.	13.67 per ct.	14.37 per ct.	15.36 per ct.
Fat, ...	.42 "	4.15 "	4.87 "	5.44 "
Solids not fat, . .	9.83 "	9.52 "	9.50 "	9.92 "

These samples are from the vicinity of Amherst. No. 1 is skim milk.

2. Fodder and Fodder Analyses.

The application of an intelligently devised system of chemical tests, for the purpose of ascertaining the amount and the relative proportions of the essential proximate constituents of our fodder articles, has rendered valuable services to practical agriculture. The chemical analysis of plants during their successive stages of growth has shown marked alterations in their composition, as far as the *absolute amount* of vegetable matter, as well as the *relative proportion* of the essential plant-constituents, are concerned. It has rendered not less conspicuous the important influence which the soil in its varying state of fertility exerts on the quantity and the quality of the growth raised upon it. The lessons derived from this source of information have stimulated inquiries concerning the safest modes of manuring, of cultivating and of harvesting our different farm crops with the prospect of securing the most satisfactory returns under existing circumstances.

A better knowledge regarding the particular quality of the various articles of fodder at our disposal improves our chances of supplementing them judiciously and thus economically, for different kinds of farm live-stock, as well as for different conditions and functions of the same kind. It furnishes, also, a safer basis for the explanation of the results obtained in actual feeding experiments. To study the nutritive value or feeding effect of any of our fodder articles by actual feeding experiments, without learning, as far as practicable, something more definite regarding its peculiar quality or composition, deprives the results obtained largely of their general interest, for they are secured under ill-defined circumstances. The chemical analysis of an article of fodder is for these reasons considered the first step required to render an intelligent interpretation of the results in feeding trials possible. Actual feeding experiments have shown that *three groups of plant constituents*, namely, *nitrogenous*, *non-nitrogenous* and *mineral constituents*, are *needed* to successfully sustain animal life. No one or two of them, alone, can support it for any length of time. In case the food does not contain digestible non-nitrogenous substances, the fat and a portion of the muscles of the animal on trial will be consumed in the support of respiration before its life terminates. In case digestible nitrogenous constituents are excluded from the diet, the formation of new blood and flesh from the food consumed ceases; for the animal system, according to our present state of information, is not capable of producing its principal constituents from anything else than the nitrogenous constituents of the plants.

Herbivorous animals receive these substances directly from the plants; carnivorous animals indirectly, by feeding on herbivorous animals. We feed, at present, our farm-stock too frequently, without a due consideration of the general natural law of nutrition; to deal out our fodder crops only with mere reference to name, instead of making ourselves more familiar with their composition and their particular quality, deprives us even of the chance of drawing an intelligent conclusion from our present system of feeding.

To compound the animal diet with reference to the particular organization of the animal, its age and its functions, is of no more importance than to select the fodder substances with reference to its special wants, as far as the absolute and relative quantity of the three essential groups of food constituents are concerned.

The peculiar character of our home-raised fodder articles is apt to conceal their special deficiency for the various purposes they are used for in general farm management. They all contain the three essential food constituents, yet in widely varying proportions; and they ought, therefore, to be supplemented in different directions to secure their full economical value. To resort to more or less of the same fodder article to meet the special wants, may meet the case as far as an efficient support of the animal is concerned, yet it can only in exceptional cases be considered good economy.

To satisfy the craving of the stomach and to feed a nutritious food are both requirements of a healthy animal diet, which, each in its own way, may be complied with. The commercial fodder substances — as oil-cakes, mill refuse brans, and our steadily-increasing supply of refuse materials from breweries, starch works, glucose factories, etc. — are admirably fitted to supplement our farm resources for stock feeding; they can serve in regard to animal growth and support, in a similar way as the commercial fertilizers in the growth of our farm crops, by supplementing our home manurial resources. To feed an excess of food materials, as roots, potatoes, etc., which contain a large proportion of non-nitrogenous matter, as starch, sugar, digestible cellular substance, etc., means direct waste, for they are ejected by the animal, and do not even materially benefit the manure heap. In case of an excessive consumption of nitrogenous constituents, — as oil-cakes, brans, gluten meal, etc., — a part of the expense is saved in an increased value of the manure obtained, yet scarcely enough to recommend that practice beyond merely exceptional cases. The aim, therefore, of an economical stock-feeding must be to compound our various fodder materials in such a manner that the largest quantity of each of the three above-stated groups of fodder substances, which the animal is capable of assimilating, should be contained in its daily diet to meet the purpose for which it is kept.

To compound the fodder rations of our farm stock, with reference to the special wants of each class of them, is an essential requirement for a satisfactory performance of their functions; to supply these wants in an economical way controls the financial success of the industry. From these and similar considerations it will be apparent that the development of a more rational, and thus more economical, system of feeding farm live-stock requires the following kind of information: —

First. How much of each of the three essential groups of food-constituents is contained in the fodder we feed?

Second. How much of each of these essential food-constituents is digestible under existing circumstances, and is thus directly available to the particular animal on trial?

Third. How much of each of the three essential food-constituents does each kind of animal require to secure the best results?

More than twenty-five years have passed by since these questions have seriously engaged the attention of skilful experimenters. Sufficient valuable information has been secured in the course of time to encourage the use of the adopted methods of observation, and to impart to many of the conclusions arrived at, a just claim for a serious consideration on the part of practical agriculturalists. The fact that much needs still to be learned to meet the reasonable expectations of those engaged in the development of a more economical system of feeding farm live-stock cannot be considered a valid reason why we should not make an intelligent use of what we have learned.

The chemical analysis of a fodder article is carried on with a view to determine the quantity of each group of its constituents, which is considered an essential ingredient of a complete food for the support of animal life. Our modes of analyzing articles of fodder are practically the same, wherever this work is carried out intelligently. The results obtained are, therefore, applicable for the determining of a comparative value wherever the identity of the material can be established.

The actual results of the analysis are usually reported under the following headings: —

1. Amount of moisture lost at 110° C., or 230° F., and amount of dry matter left behind.
2. Amount of mineral matter left behind after a careful incineration of the material.
3. Amount of organic nitrogenous matter, commonly called crude protein.
4. Amount of non-nitrogenous organic matter, exclusive of fat and of coarse cellulose substances.

The entire mass which any fodder substance leaves behind after being heated at one hundred and ten degrees, Centigrade thermometer, is called dry matter. An increase in dry substance in case of any plant or part of plant at the same stage of growth, indicates usually a higher feeding value. To satisfy the cravings of the animal, a certain quantity or bulk of coarse, dry matter becomes an important consideration in making up the fodder rations for different classes of animals. In raising young stock for fattening purposes, a liberal supply is also desirable, to effect a proper distension of the digestive organs, to make them good feeders hereafter.

Nitrogenous substances, or protein matter, refer to several groups of nitrogen-containing compounds, of plants in particular, as albumin, fibrin, legumin, casein, etc., which are essential for the formation of blood and tissues. Those contained in animal matter, as meat refuse, are frequently considered of a higher value than those in many plants.

Non-nitrogenous substances include, in particular, starch, sugars, organic acids, gums, fats and the digestible portion of the cellular matter of the fodder. These substances are readily transformed within the digestive organs into soluble compounds of a similar chemical character, and are thus assumed to serve an identical physiological purpose. As more recent investigations have shown a superior physiological value of fat, — one of the non-nitrogenous constitutents, — two and one-half times as much as starch, sugar, and other representatives of that group, its amount is separately recorded. The same course, for similar reasons, has of late been adopted with reference to certain forms of nitrogenous organic constituents of fodder articles.

Fatty substances include all the various natural fats of the plant. Most plants contain more than was assumed at an earlier stage of inquiry. As the fat is separated by means of ether, the statements in the analyses do not exactly express the amount of fatty matter alone, but include more or less resinous substances, wax, etc., which are largely soluble in ether, and of a similar highly carbonaceous character. The fat of the fodder seems to serve, in case of judicious fodder rations, mainly to increase the stock of fat in the animal which consumes the fodder.

Wherever the article has been tested by actual feeding experiment under skilful observation, the amount of each essential group of food constituents which has been shown to be digestible is reported in connection with the chemical analysis, under the heading *Digestible Portion*, per hundred weight or per ton. The higher or lower degree of digestibility of a fodder article exerts a decided influence on its nutritive value. Different stages of growth affect the rates of digestibility of the various plant constituents. The same feature is noticed in regard to different parts of plants, as well as in case of different kinds of animals.

More than two hundred fodder articles have thus far been studied under varying circumstances, and most of our current kinds of fodders have been tested in Europe and elsewhere, in numerous well-conducted feeding experiments with a suitable selection of different kinds of farm live-stock. This fact imparts to many of the results recorded a sufficient importance to recommend them as a basis of new feeding trials, with feed stuffs raised in our climate, or obtained in our home industries.

The last, but not least important, column of the statement of the chemical analysis — quite frequently found in the general record of a fodder for a practical agricultural purpose — is that of "Nutritive Ratio." These words are used to express the numerical relation of its *digestible nitrogenous substances* taken as one, as compared with the sum of its *digestible non-nitrogenous organic substances*, fat included. The information derived from that statement is very important; for it means to express the summary of results secured by actual feeding trials under specified conditions, and with the aid of the best-endorsed chemical modes to account for the constituents of the food before and after it has served for the support of the animal on trial.

Experience has shown that different kinds of animals, as well as the same kind at different ages and for different functions, require a different proportion of the essential groups of food constituents to produce in each case the best results. A statement of the nutritive ratio of a fodder article — otherwise well adapted as an ingredient of a daily diet in the case under consideration — indicates the direction in which the material has to be supplemented to economize to a full extent its various constituents.

Practical trials with milch cows have demonstrated that they require for the highest production of a good milk and the maintenance of a healthy live weight, the most nutritious food we are in the habit of giving to full-grown farm animals. Careful examinations into the composition of an efficient diet for milch cows have shown that it contains one part of digestible nitrogenous matter to from five to five and a half parts of digestible non-nitrogenous organic matter. A due consideration of these facts renders it but natural that a good corn ensilage, which has a nutritive ratio of from 1 to 10 to 1 to 12, needs a liberal addition of substances like oil-cakes, wheat bran, gluten meal, etc., which have a nutritive ratio of 1 to from 2.5 to 4, to secure its full value as an ingredient of a daily diet in the dairy; or that good hay shows less the beneficial effects of an addition of these valuable waste products than that of an inferior quality. The nutritive ratio of hay may vary from 1 to 5.5 to from 1 to 9 or more.

The value of an article of fodder may be stated from two different standpoints, — that is, with reference to its cost in the local market, and with reference to its nutritive feeding value. The market price may be expressed by a definite sum for each locality; it depends on demand and supply in the market, and it is beyond the control of the individual farmer. The nutritive value, or commonly called food value, of the article cannot be expressed by a definite sum; it varies with a more or less judicious application, and depends also, to a considerable degree, on its adaptation under varying circumstances. To secure the most satisfactory returns from feeding our home-raised fodder crops is as important a question as that of raising them in an economical manner. The great progress which has been made during the past ten or twelve years in regard to the proper mode of feeding plants ought to serve as an encouragement to undertake the task of inquiring more systematically into the proper mode of feeding our farm live-stock in the most profitable way.

CHICAGO GLUTEN MEAL.

[Bought at Springfield, Mass., 1886.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	8.95	179.00	–	–	1 : 3.00
Dry Matter,	91.05	1,821.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	.76	15.20	–	–	
“ Cellulose,	1.58	31.60	10.74	34	
“ Fat,	7.51	150.20	114.15	76	
“ Protein (Nitrogenous Matter),	30.81	616.20	523.77	85	
Non-nitrogenous Extract Matter,	59.34	1,186.80	1,115.59	94	
	100.00	2,000.00	1,764.25	–	

WHEAT BRAN.

[From a Mill in Amherst, 1886.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	10.00	200.00	–	–	1 : 3.84
Dry Matter,	90.00	1,800.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	6.11	122.20	–	–	
“ Cellulose,	7.60	152.00	30.40	20	
“ Fat,	6.08	121.60	97.28	80	
“ Protein (Nitrogenous Matter),	18.63	372.60	327.89	88	
Non-nitrogenous Extract Matter,	61.58	1,231.60	985.28	80	
	100.00	2,000.00	1,440.85	–	

WHEAT MIDDLINGS.

[Sent on from Bolton, Mass.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . . .	10.55	211.00	Not determined by actual feeding tests.	Not determined by actual feeding tests.	
Dry Matter, ...	89.45	1,789.00			
	100.00	2,000.00			
Analysis of Dry Matter.					
Crude Ash, ...	2.49	49.80			
" Cellulose, ...	1.40	28.00			
" Fat, ...	4.26	85.20			
" Protein (Nitrogenous Matter), ...	19.21	384.20			
Non-nitrogenous Extract Matter, ...	72.64	1,452.80			
	100.00	2,000.00			

The composition is very fair, and its mechanical condition was not less satisfactory.

WHEAT MIDDLINGS.

[Sent from Barre, Mass.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . . .	9.85	197.00	Not determined by actual feeding tests.	Not determined by actual feeding tests.	
Dry Matter, ...	90.15	1,803.00			
	100.00	2,000.00			
Analysis of Dry Matter.					
Crude Ash, ...	2.53	50.60			
" Cellulose, ...	2.75	55.00			
" Fat, ...	3.19	63.80			
" Protein (Nitrogenous Matter), ...	17.23	344.60			
Non-nitrogenous Extract Matter, ...	74.30	1,486 00			
	100.00	2,000.00			

This material contains less fat and nitrogenous matter than the previous one, yet not less than samples from the same mill may show at different times.

RYE BRAN.

[From Amherst Mill, 1886.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	8.18	163.60	–	–	1 : 5.45
Dry Matter,	91.82	1,836.40	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	3.43	68.60	–	–	
" Cellulose,	3.46	69.20	6.23	9.0	
" Fat,	3.03	60.60	34.85	57.5	
" Protein (Nitrogenous Matter),	16.52	330.40	218.06	66.0	
Non-nitrogenous Extract Matter,	73.56	1,471.20	1,096.04	74.5	
	100.00	2,000.00	1,355.18	–	

The material has a fair composition. Recent observations by careful observers seem to indicate that it ought not to take the place of wheat bran in the dairy.

HOMINY MEAL.

[Sent on from Berlin, Mass.]

51.64 per cent. passed through Mesh 144 to square inch.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Contituents.	Nutritive Ratio.
Moisture at 100° C.,	10.70	214.00	–	–	1 : 8.75
Dry Matter,	89.30	1,786.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	2.82	56.40	–	–	
" Cellulose,	3.69	73.80	25.09	34	
" Fat,	10.88	217.60	165.38	76	
" Protein (Nitrogenous Matter),	11.88	237.60	201.96	85	
Non-nitrogenous Extract Matter,	70.73	1,414.60	1,329.72	94	
	100.00	2,000.00	1,722.15	–	

The composition is that of a good article of its kind.

CORN COB MEAL (Corn and Cob).

[Collected at a mill near Amherst, Mass., 1886.]

	Per cent.
Moisture at 100° C.,	9.45
Dry Matter,	90.55
	100.00

Analysis of Dry Matter.

	Per cent.
Crude Ash,	1.64
" Cellulose,	6.32
" Fat,	5.19
" Protein (Nitrogenous Matter),	9.85
Non-nitrogenous Extract Matter,	77.00
	100.00

The composition of this article depends somewhat on the relative weight of cob and kernels; the former may vary from 14 to 18 per cent. in current varieties. See article "On different varieties of corn, etc." (Secretary's Report of Massachusetts State Board of Agriculture, 1879–80, pages 222 to 254.)

YELLOW SWEET CORN.

[Raised on the fields of the Experiment Station, 1885.]

Ears from fire to seven inches in length, having eight rows of kernels. Weight of an average ear, 70.16 grammes; weight of kernels, 57.40 grammes, or 81.8 per cent.; weight of cob, 12.76 grammes, or 18.2 per cent. Average weight of a kernel, 0.232 grammes.

	Per cent.
Moisture at 100° C.,	10.90
Dry Matter,	89.10
	100.00

Analysis of Dry Matter.

	Per cent.
Crude Ash,	2.16
" Cellulose,	2.58
" Fat,	4.25
" Protein (Nitrogenous Matter),	12.61
Non-nitrogenous Extract Matter,	78.40
	100.00

The article is somewhat deficient in fat, as compared with "Blue Mexican" or Crosby's.

"SELF-HUSKING" CORN.

[Experiment Station, 1885.]

Ears eight rows, eight to ten inches long. Kernels of a reddish or brownish red color. Weight of an average ear, 142.7 grammes; consisting of 88.08 per cent. kernels, and 11.92 per cent. cob. Average weight of a single kernel, .37 grammes.

	Per cent.
Moisture at 100° C.,	12.10
Dry Matter,	87.90
	100.00

Analysis of Dry Matter.

	Per cent.
Crude Ash,	1.74
" Cellulose,	2.52
" Fat,	5.44
" Protein (Nitrogenous Matter),	12.47
Non-nitrogenous Extract Matter,	77.83
	100.00

SWEET APPLE POMACE.

[Sent on for examination from Prescott, Mass., 1885.]

	Per cent.
Moisture at 100° C.,	77.87
Dry Matter,	22.13
	100.00

Analysis of Dry Matter.

	Per cent.
Crude Ash,	1.96
" Cellulose,	8.82
" Fat,	3.16
" Protein (Nitrogenous Matter),	6.70
Non-nitrogenous Extract Matter,	79.36
	.100.00

CORN REFUSE FROM STARCH FACTORY.

[Sent on from New Bedford, Mass.]

	Per cent.
Moisture at 100° C.,	57.04
Dry Matter,	42.96
	100.00

Analysis of Dry Matter.

	Per cent.
Crude Ash,	0.90
" Cellulose,	7.54
" Fat,	10.17
" Protein (Nitrogenous Matter),	22.41
Non-nitrogenous Extract Matter,	58.98
	100.00

The above-named material, which furnished the sample sent on for examination, had been bought at a corn-starch factory at Long Island, N. Y., for feeding cattle. Forty tons had been loaded at New Bedford, at $8 per ton of forty bushels. Some doubts had been expressed in regard to its fitness as a feed for milch cows.

The sample we received was apparently in a fair state of preservation, and consisted mainly of a soft, yellowish-white mass, interspersed with coarse fragments of the skin of the corn. The entire mass, in an air-dried state, was quite soft and friable, and of a peculiar vegetable, yet not offensive odor.

The composition of the vegetable matter contained in the article is that of a valuable ingredient for the compounding of a suitable diet for various kinds of farm live-stock, and in some respects similar to that of the refuse grain from breweries. The main objectionable feature of the fresh factory refuse consists in the presence of a large amount of moisture, and its liability to suffer a rapid and serious deterioration in consequence of a careless keeping, in particular during the warmer seasons of the year. Two modes of treatment for the preservation of fodder articles like the one here under discussion suggest themselves in this connection, — the silo system and the drying apparatus. The above-described corn-starch factory refuse, in its dried state, could command a price from $16 to $18 per ton in our markets.

The fitness of this class of refuse material from glucose and starch factories, as well as from brewers' grains, as an ingredient of a daily fodder ration for all kinds of farm live-stock, the dairy cow included, is quite generally conceded, provided they are in a fair state of preservation. Excessive and exclusive feeding of many fodder articles is an objectionable practice; this applies as much to corn ensilage, roots and apples, as to the waste products of the factories above enumerated.

All fodder articles of a perishable character deserve the serious attention of farmers, for they are apt to become objectionable sooner or later, if carelessly kept. In an advanced state of fermentation they are decidedly objectionable, for various reasons; they may become even poisonous in consequence of their liability to turn into hot-beds of a dangerous, parasitic growth. Musty corn meal, oil cakes, etc., are known to have been the direct cause of the death of cows.

"THE CONCENTRATED FEED."

[Sent on by South Deerfield Farmers' Club, South Deerfield, Mass.]

97.52 per cent. passed through Mesh 144 to the square inch.

	Per cent.
Moisture at 100° C.,	10.65
Crude Ash,	14.48
" Cellulose,	9.31
" Crude Fat,	4.30
" Protein (Nitrogenous Matter),	13.90
Non-nitrogenous Extract Matter,	47.36
	100.00

Analysis of Dry Matter.

	Per cent.
Crude Ash,	16.21
" Cellulose,	10.42
" Fat,	4.81
" Protein (Nitrogenous Matter),	15.56
Non-nitrogenous Extract Matter,	53.00
	100.00

The material was received in a bag marked "The Concentrated Feed Company, Boston, Mass." A circular, from the agent at South Deerfield, contained a statement of an analysis of the article, which, as far as essential points are concerned, does not materially differ from our own, above reported.

The material was of a good, mechanical condition, and consisted evidently of a mixture of several ingredients: among them was noticeable common salt. An actual test showed the presence of 7.4 per cent. of chlorine, which indicates the presence of from 11 to 12 per cent. of common salt. On inquiry it was learned that "The Concentrated Feed" sold at $8 per one hundred weight, — a most remarkable price for an article of fodder without any stated guaranty of its various ingredients, nor any statement of its rate of digestibility under some specific conditions. The selling price of the article seems to be based largely on the merits of the invention of the compound. It would be no difficult task to compound from our most reputed concentrated feed-stuffs, even without a liberal addition of common salt, an article which would conform to the composition claimed by the manufacturer of "The Concentrated Feed," and at the same time could be sold with a good compensation to the agent, even in remote localities, at a less price per ton than "The Concentrated Feed" sells for per five hundred pounds.

From remarks in previous pages it must be apparent that a mere analysis of a fodder article, without any further reliable information concerning its source and its special character, is no safe basis for a decision regarding its particular value for feeding purposes. The practice of buying compound feed-stuffs in the general market, without a sufficient actual knowledge regarding the kind or the character of their varied ingredients, ought to be decidedly discouraged; for the farmer who pursues that course leaves his best interests to mere chance. To feed commercial compound feed-stuffs without some more positive knowledge of the articles which constitute them can impart but little useful information for future operation beyond the lesson to be less credulous hereafter.

3. ANALYSES OF FEED-STUFFS WITH REFERENCE TO THE FERTILIZING CONSTITUENTS THEY CONTAIN.

The composition of the various articles of food used in farm practice exerts a decided influence on the manurial value of the animal excretions resulting from their use in the diet of different kinds of farm live-stock. The more potash, phosphoric acid, and in particular nitrogen, a fodder ingredient contains, the more valuable will be, under otherwise corresponding circumstances, the manurial residue left behind, after it has served its purpose as a constituent of the food consumed.

As the financial success in most farm managements depends in a considerable degree on the amount, the character and the cost of the manurial refuse material secured in connection with the special farm industry carried on, it needs no further argument to prove that the relations which exist between the composition of the fodder and the value of the manure resulting, deserves the careful consideration of the farmer, when devising an efficient and at the same time an economical diet for his live stock.

The question whether one or the other fodder mixture will prove ultimately, under otherwise corresponding circumstances, the cheapest one, can only be answered intelligently when both the original cost of the feed consumed and the value of the manurial residue subsequently obtained are duly considered.

The close relation, which quite necessarily exists in most farm managements between the system of cultivating the lands and the keeping of farm live-stock for farm work, for the dairy and for the supply of food for the general market, imparts to the barn-yard manure a special if not a controlling importance as a valuable manurial resource. The barn-yard manure ought to remain in a judicious system of mixed farming, — not only the main reliance of the farmer for plant food, but also the cheapest manure at his disposal. The objections raised at times against a liberal use of barn-yard manure ought not to rest on its higher cost of production, when compared with other manurial substances in our market. The name "barn-yard manure" is, however, too frequently used without any particular discrimination with reference to all kinds of manurial refuse obtained in connection with stock feeding and stock raising, which are frequently of widely differing composition. To approximate even fairly the comparative value of two samples obtained on different farms remains a hopeless task, as long as a more definite information regarding the following points is wanting: —

1. The character of the fodder consumed.

2. The kind, the age and the function of the animal which served for its production.

3. The nature and the quantity of the material which served for the absorption of the animal excretions.

4. The care bestowed upon collecting and preserving the entire liquid and solid excretions.

Assuming for our present purpose, in both instances, identical conditions, as far as the kind of animal, the mode of collecting and the care of keeping the manuare are concerned, it will be apparent that the relative value of the two kinds of barn-yard manure stand essentially in a direct relation to the amount of nitrogen, potash, phosphoric acid, etc., which was contained in the feed consumed.

The following analyses of fodder articles are obtained at the laboratory of the Station, from fair samples which came under our observation.

A series of similar analyses of fodder crops, based mainly on the average analyses of E. Wolff, are published in the Annual Report of the Secretary of the Massachusetts Board of Agriculture for 1885, page 146.

I. CORN COBS.

[Average result of four current varieties of corn raised in Hampden and Hampshire counties, Mass.]

	Per cent.
Moisture at 100° C.,	10.00
Nitrogen in organic matter (17 cents per pound),	0.54
Crude ash,	1.03
Silica,	0.20
Ferric oxide,	0.01
Calcium oxide,	0.03
Magnesium oxide,	0.06
Potassium oxide (4¼ cents per pound),	0.68
Sodium oxide,	0.04
Phosphoric acid (6 cents per pound),	0.08
Valuation per 2,000 lbs.,	$2 52

2. CORN MEAL.

[From mill at Amherst, Mass.]

	Per cent.
Moisture at 100° C.,	10.00
Nitrogen in organic matter (17 cents per pound),	1.86
Crude ash,	1.50
Silica,	0.005
Ferric oxide,	0.015
Calcium oxide,	0.027
Magnesium oxide,	0.197
Potassium oxide (4¼ cents per pound),	0.45
Sodium oxide,	0.064
Phosphoric acid (6 cents per pound),	0.77
Valuation per 2,000 lbs.,	$7 62

3. VILMORIN (SUGAR BEET). 4. GLOBE MANGOLD.

	POUNDS PER HUNDRED.	
	3	4
Moisture at 100° C.,	85.99	88.27
Dry matter,	14.01	11.73
Nitrogen (17 cents per pound),	.29	.30
Crude ash,	.62	.94
Potassium oxide (4¼ cents per pound),	.18	.44
Sodium oxide,	.18	.30
Calcium oxide,	.06	.03
Magnesium oxide,	.04	.04
Phosphoric acid (6 cents per pound),	.03	.02
Ferric oxide,	.01	.003
Insoluble matter,	.10	.09
Valuation per 2,000 lbs.,	$1 18	$1 43

Relative Percentage of Soluble Essential Constituents in One Hundred Parts of Ash (3-4).

	3	4
Potassium oxide,	36.648	53.156
Sodium oxide,	35.795	35.764
Calcium oxide,	11.932	3.366
Magnesium oxide,	7.103	4.488
Phosphoric acid,	6.534	2 805
Ferric oxide,	1 988	0.421
	100.000	100.000

WHOLE APPLES.

5. Rhode Island Greenings. 6. Sweet Apples.

	Pounds per Hundred.	
	5	6
Moisture at 100° C.,	84.650	75,170
Dry matter,	15.350	24.830
Nitrogen (17 cents per pound),	.113	.156
Crude ash,	.327	.501
Potassium oxide (4¼ cents per pound),	.122	.269
Sodium oxide,	.013	.042
Calcium oxide,	.023	.044
Magnesium oxide,	.025	.029
Ferric oxide,	.001	.005
Phosphoric acid (6 cents per pound),	.008	.011
Insoluble matter,	.002	.004
Valuation per 2,000 lbs.,	$0 49	$0 60

APPLE POMACES.

7. Rhode Island Greenings. 8. Baldwin Apple.

	Pounds per Hundred.	
	7	8
Moisture at 100° C.,	78.220	82.780
Dry matter,	21.780	17.200
Nitrogen (17 cents per pound),	.241	.213
Crude ash,	.237	.306
Potassium oxide (4¼ cents per pound),	.119	.150
Sodium oxide,	.032	.020
Calcium oxide,	.042	.032
Magnesium oxide,	.027	.028
Ferric oxide,	.008	.008
Phosphoric acid (6 cents per pound),	.017	.018
Insoluble matter,	.009	.008
Valuation per 2,000 lbs.,	$0 92	$0 87

The composition of the apples which served for the above analyses of pomaces has been described in the Third Annual Report of the Experiment Station, pages 86, 87.

9. WHEAT MEAL.

[From a mill in Amherst, Mass.]

	Per cent.
Moisture at 100° C.,	9.83
Nitrogen in organic matter (17 cents per pound),	2.21
Crude ash,	1.22
Magnesium oxide,	0.05
Calcium oxide,	0.17
Potassium oxide (4¼ cents per pound),	0.54
Sodium oxide,	1.06
Phosphoric acid (6 cents per pound),	0.57
Valuation per 2,000 lbs.,	$8 75

10. WHEAT MIDDLINGS.

[From a mill in Amherst, Mass.]

	Per cent
Moisture at 100° C.,	9.18
Nitrogen in organic matter (17 cents per pound),	2.63
Crude ash,	2.30
Magnesium oxide,	0.21
Potassium oxide (4¼ cents per pound),	0.63
Calcium oxide,	0.20
Sodium oxide,	0.11
Phosphoric acid (6 cents per pound),	0.95
Valuation per 2,000 lbs.,	$10 63

11, 12. WHEAT BRAN.

[From a mill in Amherst, Mass.]

	Per cent.	
	11	12
Moisture at 100° C.,	11.45	9.40
Phosphoric acid (6 cents per pound),	3.05	3.12
Magnesium oxide,	0.90	0.91
Sodium oxide,	0.09	0.16
Potassium oxide (4¼ cents per pound),	1.49	1.42
Nitrogen in organic matter (17 cents per pound),	2.82	3.08
Insoluble matter,	0.11	0.15
Valuation per 2,000 lbs.,	$14 52	$15 42

The above analyses refer to the quality of bran fed of late at the Station.

13. PROVENDER.

	Per cent.
Moisture at 100° C.,	10.48
Phosphoric acid (6 cents per pound),	0.78
Magnesium oxide,	0.05
Calcium oxide,	0.18
Sodium oxide,	0.22
Potassium oxide (4¼ cents per pound),	0.37
Nitrogen in organic matter (17 cents per pound),	2.10
Insoluble matter,	0.29
Valuation per 2,000 lbs.,	$8 40

The above provender consisted of 100 lbs. of wheat bran, 125 lbs. of oats and 450 lbs. of corn-meal.

14. GLUTEN MEAL.

[Bought at Springfield, Mass.]

	Per cent.
Moisture at 100° C.,	9.00
Nitrogen in organic matter (17 cents per pound),	5.44
Crude ash,	0.70
Calcium oxide,	0.058
Magnesium oxide,	0.034
Potassium oxide (4¼ cents per pound),	0.06
Sulphuric acid,	0.021
Phosphoric acid (6 cents per pound),	0.45
Valuation per 2,000 lbs.,	$19 05

FIELD EXPERIMENTS.

[Field A.]

1. Fodder Corn raised upon underdrained and exhausted Lands, partly Fertilized with Single Articles of Plant Food, partly without the use of any Manurial Matter.

In the first Annual Report of the Station has been described the underdraining of a piece of land, one and one-tenth of an acre in size, subdivided into eleven plats. The field was to serve for an examination into the actions of various manurial substances on the growth of corn, and the influence on the character of the drainage water discharged from the drains, under a different treatment of the soil. It had been used for several years previous to the establishment of the Experiment Station in 1882 as a meadow for the production of hay. During the spring of 1883 it was planted with corn (Longfellow variety), for fodder corn, without the use of any fertilizer, The same course of planting and cultivation was carried out during 1884 (changing from the Longfellow to the Clark variety of corn) for the purpose of exhausting the soil, as far as practicable, for the cultivation of corn with any prospect of remunerative returns.

The corn crop raised in 1884 upon these eleven plats of unmanured land left no doubt about their exhausted condition, as far as a further successful cultivation of corn was concerned; for the entire yield of corn fodder from this piece of land, one and one-tenth of an acre in size, amounted to 5,040 pounds, with a moisture of thirty per cent.

These results encouraged the beginning of a special inquiry into the chemical and physical condition of our soil, as far *as its relation to the production of the corn crop is concerned*, as well as into *its particular power to retain*, in a higher or lower degree, *various articles of plant food;* i. e., its qualification to prevent their passage into the drainage water.

With these ends in view, the following course was decided upon, and carried out during the succeeding season (1885).

The entire field (A) was prepared, May 12, in a similar manner for the planting of corn as in preceding years (see Second Annual Report, page 81).

Plat No. 0, . . .	Thrown out of the experiment.
Plat No. 1, . . .	Twenty-five pounds of sodium nitrate (= to 4 lbs. of nitrogen)
Plat No. 2, . . .	Nothing.
Plat No. 3, . . .	Thirty pounds of dried blood (= to 4 lbs. of nitrogen).
Plat No. 4, . . .	Nothing.
Plat No. 5, . . .	Twenty-five pounds of ammonium sulphate (= to 5 lbs. of nitrogen).
Plat No. 6, . . .	Nothing.
Plat No. 7, . . .	Fifty pounds of dissolved bone-black (= 8.5 lbs. of available phosphoric acid).
Plat No. 8, . . .	Nothing.
Plat No: 9, . . .	Twenty-five pounds of muriate of potash (= from 12 to 13 lbs. potassium oxide).
Plat No. 10, . . .	48½ pounds potash-magnesia sulphate (= to 12–13 lbs. potassium oxide).

The growth on the entire field was cut September 5, and the product of each plat stacked by itself in the field for drying; it was housed October 10, with the following results: —

1885.

PLAT.	Amount of Dry Corn Fodder Obtained.	Fertilizer Applied.
No. 1, . .	480 lbs.	25 lbs. of sodium nitrate (= 4 lbs. of nitrogen).
2, . .	310 "	Nothing.
3, . .	350 "	30 lbs. of dried blood (= 4 lbs. of nitrogen).
4, . .	300 "	Nothing.
5, . .	360 "	25 lbs. of ammonium sulphate (= 5 lbs. nitrogen).
6, . .	–	Fallow.
7, . .	280 "	50 lbs. of dissolved bone-black (= 8.5 lbs. available phosphoric acid).
8, . .	250 "	Nothing.
9, . .	945 "	25 lbs. of muriate of potash (= from 12 to 13 lbs. potassium oxide).
10, . .	845 "	48½ lbs. potash-magnesia sulphate (= from 12 to 13 lbs. of potassium oxide).

Comparing these results with those obtained in the previous year, where the produce of the various plats was practically of a corresponding weight (458 lbs. each), it was noticed that the application of potash compounds alone, muriate of potash leading (see Plats No. 9 and 10), had exerted a marked effect on the quantity and the quality of the corn fodder raised, increasing the previous annual yield not less than one hundred per cent. above that of the preceding year (1884).

The amount of corn fodder raised on Plat No. 1, which received nitrate of soda, had exceeded but slightly (22 lbs.) that of the previous season; while the application of blood, ammonium sulphate and phosphoric acid had not prevented a considerable falling off. The yield of corn fodder of fertilized and unfertilized plats was practically the same in most instances.

In sight of these facts, it seemed but justifiable to conclude that a deficiency of the soil in available potash had controlled, in our case, more than that of any other essential article of plant food, — the final yield of the crop.

As the cultivation of grasses and fodder corn affects the manurial resources of the soil in a similar direction by abstracting approximately one part of phosphoric acid to four parts of potash, it is but a natural result that a soil which originally did not contain much more of available potash than of available phosphoric acid must become unproductive before the latter is exhausted. In case circumstances necessitate a direct succession of these two crops, it is well to remember that fact, and to provide against a failure by applying to the soil liberally, in particular, potash compounds in some form or other. Muriate of potash deserves recommendation.

To verify the above conclusion, the experiment was continued during the past season (1886), with the sole modification of increasing on each fertilized plat the particular fertilizing ingredients to twice the amount used in the preceding year.

The plats were thoroughly plowed and harrowed May 15, 1886. The fertilizers were sown broadcast in each case, and slightly harrowed in before planting the corn, in rows, May 21 and 22 (Clark's variety). The rows were three feet three inches apart. The seeds were dropped from twelve to fourteen inches apart and six to eight kernels in a place. The young plants appeared uniformly and healthy looking in all plats June 1. They turned, however, into a pale green color by June 28, with the exception of those on Plats 9 and 10. The latter were still of a dark green color September 11, when the entire crop was cut and stooked in the field. The corn growing on Plats 1 to 8 inclusive had reached at the end of the season a height of from two to four feet, and showed only here and there a partially filled ear; it was badly dried up and unhealthy looking when cut. The plants grown upon Plats 9 and 10 had reached a height of from five to eight feet; the stalks and leaves were still succulent when cut, and the ears pretty well formed throughout the plats, but small, and the kernels scarcely beginning to glaze.

The weight of the corn fodder raised upon each plat was ascertained October 23, when the crop was housed. The subsequent tabulated statement contains the results of the experiments. The weights of the corn fodder are stated with reference to the same state of moisture (from 45 to 50 per cent.) as in the preceding year, to allow a comparison of the results.

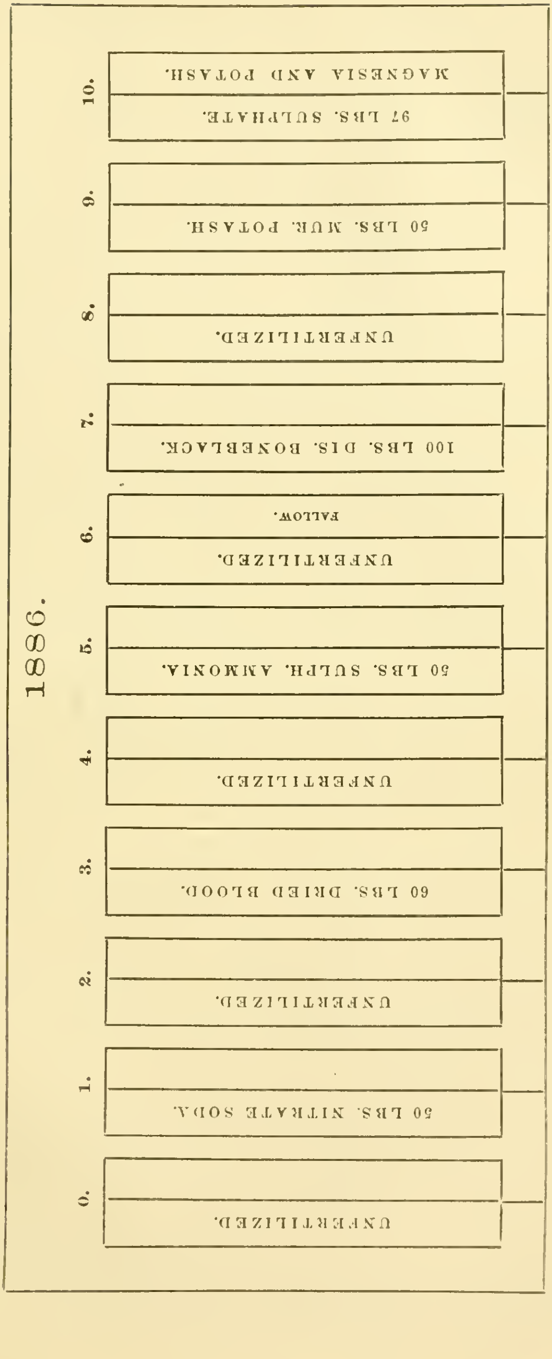
1886.

PLAT.	Amount of Dry Corn Fodder Obtained.	Fertilizer Applied.
No. 1, . .	430 lbs.	50 lbs. of sodium nitrate (= 7–8 lbs. of nitrogen).
2, . .	250 "	Nothing.
3, . .	310 "	60 lbs. of dried blood (= 7–8 lbs. of nitrogen).
4, . .	250 "	Nothing.
5, . .	280 "	50 lbs. of ammonia sulphate (= 10 lbs. of nitrogen).
6, . .	–	Fallow.
7, . .	255 "	100 lbs. of dissolved bone-black (= 17 lbs. available phosphoric acid).
8, . .	195 "	Nothing.
9, . .	840 "	50 lbs. of muriate of potash (= 25 lbs. of potassium oxide).
10, . .	895 "	97 lbs. of potash-magnesia sulphate (= 25 lbs. of potassium oxide).

These results, compared with those of the previous year, show still a falling off in yield in all plats, notwithstanding a decided increase of the various single manurial substances applied on Plats 1, 3, 5, 7, 9 and 10. The yield of the fertilized Plats 1, 3, 5, 7 during the last season (1886) is less than that of the unfertilized plats in 1885. The good service of potash compounds in our case is still remarkable.

The experiment will be continued, with some modifications, during the coming season.

"FIELD A."


1886.
0.
UNFERTILIZED.
1.
50 LBS. NITRATE SODA.
2.
UNFERTILIZED.
3.
60 LBS. DRIED BLOOD.
4.
UNFERTILIZED.
5.
50 LBS. SULPH. AMMONIA.
6.
UNFERTILIZED.
FALLOW.
7.
100 LBS. DIS. BONEBLACK.
8.
UNFERTILIZED.
9.
50 LBS. MUR. POTASH.
10.
97 LBS. SULPHATE.
MAGNESIA AND POTASH.

Corn Plats with Drainage System. Scale, 4 rods to 1 inch.

2. Fodder Corn and Corn Ensilage.

The last annual report on the work of the Experiment Station contains upon pages 52 and 53 a record of observations concerning the gradual increase of vegetable matter in the fodder corn during its successive stages of growth. A series of tests carried out with plants taken from our fields had demonstrated the fact that the vegetable matter in the variety of corn on trial (Clark) had increased from fifty to one hundred per cent. in actual weight, between the time of the first appearance of the tassel and the beginning of the glazing of the kernels. It was found that the same variety of corn, raised under fairly corresponding circumstances, as far as the general character of the soil and the mode of cultivation are concerned, contained in one hundred weight parts at the time of the first appearance of the tassel from twelve to fifteen weight parts of dry vegetable matter, and from eighty-five to eighty-eight parts of water; whilst at the time of the beginning of the glazing of the kernels the former was noticed to vary from twenty-three to twenty-eight weight parts, and the water from seventy-seven to seventy-two. These results of our investigation left no doubt about the fact that our green fodder corn at the time of the beginning of the glazing of the kernels contained nearly twice as much vegetable matter per ton weight of corn as at the time of the appearance of the tassels.

This feature in the change of the composition of the fodder corn during its growth is not an exceptional one; similar changes are noticed in all our farm plants. Our observations in this direction were reported for the purpose of furnishing some more definite numerical values for the consideration of our practical farmers. As long as the vital energy of an annual plant is still essentially spent in the increase of its size, as a rule but a comparatively small amount of valuable organic compounds, as starch, sugar, etc., accumulates within its cellular tissue. The comparative feeding value of the same kind of fodder plants, or any particular part of such plants, is not to be measured by its size, but by the quantity of valuable organic nitrogenous and non-nitrogenous constituents stored up in its cellular system. The larger or smaller amount of dry vegetable matter left behind from a given weight of samples of the same kind of a fodder plant of a corresponding stage of growth indicates in the majority of cases their respective higher or lower economical value for feeding purposes. Agricultural chemists, for this reason, usually begin their examination of fodder plants with a test for the determination of the amount of dry vegetable matter left behind, when carefully brought to a constant weight at a temperature not exceeding 110° C.

The taller varieties of corn are not necessarily the more valuable kinds for the production of fodder; on the contrary, it would be more judicious, on general principles, to doubt their superior fitness for that purpose until otherwise proved. This statement applies, in particular, to some varieties recently transferred to our section of the country; for they seem to require an exceptionally rich soil to yield the best results they are represented to be capable of producing. Raised in a soil of moderate resources of plant food, little of the latter can be left over, after the production of their tall stocks and bulky leaves, to assist in the formation of valuable organic compounds, as sugar, starch, fat, nitrogenous matter, etc., to enrich the entire plant. The same mode of reasoning applies to the raising of exceptionally large sized roots, potatoes, etc.; they are usually but partly matured, and thus of a watery, indifferent taste.

The general character of the climate and the physical and chemical condition of the soil control the local adaptation of a plant for successful cultivation. Extremes of season and one-sided modes of manuring are apt to modify the growth of a plant and thereby alter its composition. To learn how to check an inherent tendency of a plant to a rank growth, in the interest of a fairer chance for a complete maturity of the final crop, is most desirable information to secure; for success in that direction insures not unfrequently a superior pecuniary return. A careful study of the special characteristics of the plant on trial under the influence of existing local resources of the soil and of the prevailing local features of the weather during the growing season alone, can furnish a safe guide for the attainment of the desired end.

The determination of the relative feeding value of different samples of the same kind of plants raised under different circumstances is always carried out with plants of a corresponding stage of growth. Progress in the growth of plants alters their composition in regard to the quantity of vegetable matter which they contain in a given weight; it also changes very materially the absolute and relative proportion of their essential food constituents, *i. e.* their nutritive value.

The amount of vegetable matter in a given weight of green fodder corn cut at the beginning of the glazing of the kernels is known to be not only nearly twice as large as compared with that contained in an equal weight of green fodder corn cut when just showing the tassels, it is also known to be pound for pound more nutritious, for it contains more starch, more sugar, more of valuable nitrogenous matter, etc.

Considering the previously stated views correct, we filled our silos during last autumn with fodder corn, which had just reached the point where the kernels began to glaze over, expecting to secure an ensilage of superior feeding value. The results of our experiments in that direction have been very satisfactory, and may be summed up as follows:—

1. The course adopted for the production of corn fodder for the silo secures the largest amount of valuable matter which a given area of land planted with fodder corn can produce under corresponding circumstances, as far as land and season are concerned.

2. The ensilage of a more matured fodder corn has a higher feeding value, pound for pound, than that cut at an earlier stage of growth.

3. The more matured fodder corn, on account of a harder texture, is less crushed by close packing, and consequently better resists the peculiar influences which tend to deteriorate and ultimately destroy the contents of the silo.

As a more detailed description of the products of our silo may not be without some interest to our readers at this period of the season, we publish below the essential part of our results, beginning with an abstract from our late annual report, which relates briefly the course pursued in filling the silo.

The corn fodder, when cut for the silo, September 3 and 4, began to acquire a slightly yellowish tint along the outside of the field, yet was still green and succulent in the interior parts;

the kernels were soft, their contents somewhat milky, and their outside just beginning to glaze.

Corn Ensilage. — Two silos of the same size, five by fourteen feet, inside measure, and eleven feet deep, were used for the experiment. In both instances the corn was cut into pieces from one and one-quarter to one and one-half inches in size; they were, however, filled in a different way.

Silo No. 1 was loosely filled, September 4, to about two-thirds of its height, and the mass merely levelled without treading down. It was left in this condition without covering until September 7, at 8 o'clock A. M. At this time it had settled from eighteen to twenty-four inches; the odor of acetic acid became slightly perceptible, and the pieces of cornstalk, although sweet to the taste, showed an acid reaction to the test-paper (litmus).

Sept. 7, 8 A.M.	Temperature	at 12	inches	depth,	147°, 145°, 147° F.
" 8, 8 A.M.	"	" 12	"	"	141°, 145°, 145° F.
" 8, 8 A.M.	"	" 24	"	"	136.5° F.
" 8, 8 A.M.	"	" 30	"	"	114° F.
" 8, 8 A.M.	"	" 36	"	"	107° F.

As the temperature remained practically at a standstill, the filling in of more fresh-cut corn was resumed, and the silo completely yet loosely filled, September 8. A maximum registering thermometer was buried in the mass at a depth of two feet from the surface, and light boards loosely laid over the top.

Sept. 10, 8 A.M. Temperature at 12 inches depth, 129°, 127° F.

The mass had now settled eighteen inches.

Sept. 11, 8 A.M.	Temperature	at 12	inches	depth,	127°, 129°, 131° F.
" 12, 8 A.M.	"	" 12	"	"	122°, 132° F.

The mass had settled from twenty-four to thirty inches. The temperature remained practically the same; the mass was carefully covered with tarred paper and tight-fitting boards, and subsequently, on September 12, pressed down with twenty-five barrels of sand. This silo contained about eight tons of green corn fodder.

The temperature observations above recorded were made in different parts of the silo; they show that it is quite difficult to secure a desirable uniform temperature within the mass in all parts of the silo, at the same depth and at the same time.

Silo No. 2 was filled to a depth of from eight to nine feet, as fast as the cut corn could be supplied and tramped down. As soon as the amount of corn assigned for that silo (9.5 tons) was filled in, the surface was carefully covered with tarred paper and tight-fitting boards, in the same manner as in case of the first silo, and at once pressed down with twenty-five barrels of sand. A maximum registering thermometer was safely buried at a depth of about two feet in the mass, to record the highest temperature which the latter would reach during the time of keeping the silo closed.

The silo had been closed about six months when opened. The highest temperature recorded by the thermometer buried at a depth of two feet below the surface of the ensilage, after closing the silo, was 116.5° F.

A layer of eighteen inches in thickness on the top, and from six to eight inches along the sides, was of dark color and unfit for fodder. It was removed until no mould could be noticed on the leaves and stem parts; the ears of the corn were best preserved. The main bulk of the ensilage was of a brownish yellow color, and showed a decided acid reaction to the test-paper. The odor was at first that of organic matter slowly disintegrating under the exclusion of air, but changed soon after the opening of the silo into that of acetic acid (vinegar). The free organic acids contained in one hundred weight parts of the fresh ensilage (directly after the opening of the silo) required 1.309 parts of sodium hydroxide for their neutralization, which is equal to 1.96 per cent. of acetic acid. The same quantity of fresh ensilage contained 0.0374 parts of actual ammonia. No starch could be detected in the stems and leaves, whilst an abundance of it was found in the ears.

CORN ENSILAGE.

[Taken from Silo No. 1, March 23, 1886.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	78.05	1,561.00	–	–	1 : 12.2
Dry Matter,	21.95	439.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	3.16	63.20	–	–	
" Cellulose,	20.48	409.60	294.91	72	
" Fat,	3.84	76.80	57.60	75	
" Protein (Nitrogenous Matter),	7.37	147.40	107.60	73	
Non-nitrogenous Extract Matter,	65.15	1,303.00	873.01	67	
	100.00	2,000.00	1,333.12	–	

Silo No. 2 was opened seven months after being filled. A layer about six inches in thickness had to be removed from the top and the sides of the contents of the silo to reach an acceptable fodder for cows. The highest temperature registered by the thermometer since its introduction into the silo at a depth of two feet at the time of closing was 97.8° F.

CORN ENSILAGE.

[Taken from Silo No. 2, April 25, 1886.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	76.90	1,538.00	–	–	1 : 10.4
Dry Matter,	23.10	462.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	5.22	104.40	–	–	
" Cellulose,	17.67	353.40	254.45	72	
" Fat,	3.15	63.00	47.25	75	
" Protein (Nitrogenous Matter),	8.27	165.40	120.74	73	
Non-nitrogenous Extract Matter,	65.69	1,313.80	880.25	67	
	100.00	2,000.00	1,302.69	–	

The main body of the ensilage was in fine condition, of a yellowish green color, somewhat lighter than in silo No. 1. It had a slightly acid smell and taste. To neutralize the free organic acids contained in one hundred weight parts of fresh ensilage, collected at the opening of the silo, required 1.130 parts of sodium hydroxide, which is equal to 1.95 per cent. of acetic acid. The amount of ensilage contained 0.027 parts of actual ammonia.

A comparison of these observations with those made in connection with the contents of No. 1 shows that in our case the direct filling and closing of the silo produced the best results. The contents of the silo filled at once with cut corn-fodder, and subsequently carefully closed up, had suffered less serious alteration in various directions than those that had passed through a previous heating process, in consequence of a longer exposure to atmosphoric agencies. The records of the thermometers, the chemical analysis of the enselage from both silos, and the general character of both kinds of ensilage confirm our above conclusion. Adding to these statements the circumstance that our cows decidedly preferred the ensilage from silo No. 2, we feel that we can recommend the course pursued in filling that silo. As the free acids, acetic and lactic, in a corn ensilage, however carefully prepared, steadily increase after the opening of the silo, as long as unchanged saccharine and amylaceous constituents (sugar and starch) are present, it is very important that the access of air should be limited as far as practicable. The decision in regard to the best size of the silo should be largely controlled by the possible rate of consumption. The feeding value of the contents of the most carefully packed silo is apt to be most seriously impaired in consequence of a subsequent prolonged exposure to the air. Three to four weeks' exposure altered the character of our ensilage seriously, as far as its acidity was concerned. The degree of the change depends, under corresponding circumstances, largely on the surrounding temperature. It is far less during the winter months than in April or May.

Analyses of Corn and Cob before and after their Treatment in a Silo.

[1. Corn and cob; cured naturally in the field. 2. Whole corn and cob; from silo. 3. Cut corn and cob; from silo.]

	Per Cent.		
	1	2	3
Moisture at 100° C.,	10.71	25.50	50.27
Dry Matter,	89.29	74.50	49.73
	100.00	100.00	100.00
Analysis of Dry Matter.			
Crude Ash,	2.16	1.43	1.35
" Cellulose,	5.39	8.32	8.50
" Fat,	5.27	8.66	7.84
" Protein (Nitrogenous Matter),	12.18	10.56	6.63
Non-nitrogenous Extract Matter,	75.00	71.03	75.68
	100.00	100.00	100.00

The material which served for the above analyses was sent on for that purpose during the month of September, 1886, with the following statement: The different samples were taken from the same lot of corn eleven months ago. The crop was cut when the ears began to glaze. No. 1, whole ears, was removed from the stalks and dried in the usual way on the ground; No. 2, whole ears, was buried at the same time in the silo about six feet below the surface of the cut material, which consisted of the cut stalks and cut ears; No. 3 consisted of pieces of cut ears of corn taken from the main bulk of corn ensilage at the same time when sample No. 2 was removed for an examination, about eleven months after the filling of that silo. The samples were collected for the purpose of ascertaining the character and the degree of change which the ear of the corn undergoes by converting it into ensilage, either whole or when cut into pieces. A comparison of the analytical results shows, what might be expected, that cut ears of corn are liable to suffer a more serious alteration in their composition than whole ears.

Analyses of Rowen.

[1. Sun-dried in the field. 2. After being in a silo eleven months.]

	Per Cent.	
	1	2
Moisture at 100° C.,	19.71	18.44
Dry Matter,	80.29	81.56
	100.00	100.00
Analysis of Dry Matter.		
Crude Ash,	8.99	8.76
" Cellulose,	29.43	27.93
" Fat,	4.96	6.98
" Protein (Nitrogenous Matter),	14.70	12.34
Non-nitrogenous Extract Matter,	41.92	43 99
	100.00	100.00

These analyses point in the same direction as the previous ones. The reduction of nitrogenous matter as compared with that of the non-nitrogenous extract matter is most noticeable; yet this circumstance does not represent the entire loss in organic matter. The decrease in crude cellulose and the increase in crude fat both confirm that statement. To state with more exactness the loss of organic matter in cases like those under consideration, requires a more definite knowledge regarding the amount of dry matter contained in the fresh rowen, and of the average moisture of the various layers of rowen in the silo. None of our ordinary modes of preserving fodder is without the liability of losses; it remains in most instances a matter of degree, depending quite largely on circumstances beyond the control of the farmer. Succulent plants are most likely to suffer seriously in the ordinary drying process, and it is for this reason that the silo system deserves, in particular, a careful consideration for the efficient preservation of these crops.

ENSILAGE MADE FROM APPLE POMACE.

[Amherst Mill.]

	Per cent.
Moisture at 100° C.,	85.33
Dry Matter,	14.67

Analysis of Dry Matter.

Crude Ash,	4.21
" Cellulose,	22.18
" Fat,	7.36
" Protein (Nitrogenous Matter),	8.22
Non-nitrogenous Extract Matter,	58.03
	100.00

The pomace which served for the preparation of the apple ensilage was taken from a cider-mill near Amherst towards the close of October, 1885, and consisted of the clear press refuse of a mixture of different kinds of apples.

Two casks, of a capacity of from fifty to sixty gallons each, were used for the experiment. They were painted inside with a black tar varnish to render them air and water tight. The pomace was stamped down solid, and subsequently covered with tar paper, which was held down by a layer of sand several inches in thickness, and some large stones. The casks, thus filled, were kept in a corner of the barn floor until May 17, 1886, when they were opened to examine their contents. The material was found throughout apparently as fresh as when put up; neither mouldy, rotten, or even discolored on its surface. It had a pleasant fruit-like acid odor and taste, and contained but traces of ammonia compounds. One hundred parts of the fresh apple ensilage required 0.744 parts of sodium hydroxide for the neutralization of its free organic acids, which prove thus to be less than in either kind of corn ensilage. The ensilage of apple pomace is highly relished by cows and swine, and is, if not superior, at least equal, pound for pound, in feeding value to the apple pomace, which served for its production. The nitrogenous constituents had increased at the expense of the saccharine constituents; the latter had been destroyed at a higher rate by fermentation than the former.

3. Influence of Fertilizers on the Quantity and the Quality of some Prominent Fodder Crops.

[Field B.]

The land selected for the experiment had been used, for several years previous, for the production of hay. At the beginning of the season of 1883 it had been ploughed and planted with corn, without the addition of any fertilizer. The soil consisted of a good sandy loam, and was, in consequence of its previous treatment, in a suitably impoverished condition to respond to the application of fertilizers.

The entire field, consisting at that time of one and one-tenth of an acre, was subdivided into plats, each one-tenth of an acre in size. Every alternate plat was fertilized at the rate of six hundred pounds of ground, rendered bones, and two hundred pounds of muriate of potash, per acre. The fertilizer was applied a few days before seeding, and slightly harrowed under.

The experiment in 1884 comprised four standard grasses, i. e., Orchard grass (*Dactylis glomerata*), Meadow fescue (*Festuca pratense*), Timothy (*Phleum pratense*) and Redtop (*Agrotis vulgaris*), besides two Millets, Hungarian grass (*Panicum Germanicum*) and Pearl millet (*Penicillaria spicata*), and one variety of corn, Clark. (See sketch of Field B, 1884–1885.)

The plats Nos. 11, 13, 15, 19 and 21 were fertilized; and Nos. 12, 14, 16, 18 and 20 received no manurial matter of any description.

In the case of the grasses and millets, each plat was again subdivided into two, and each half seeded down with one distinct kind of grass seed as follows: —

Plat 11 (fertilized), ...	Orchard Grass (north side), Meadow Fescue (south side).
Plat 12 (unfertilized), ...	Orchard Grass (north side), Meadow Fescue (south side).
Plat 13 (fertilized), ...	Hungarian Grass (north side), Pearl Millet (south side).
Plat 14 (unfertilized), ...	Hungarian Grass (north side), Pearl Millet (south side).

Plat 15 (fertilized),	Timothy (north side), Redtop (south side).
Plat 16 (unfertilized),	Timothy (north side), Redtop (south side).
Plat 17 (fertilized),	Corn (Clark).
Plat 18 (unfertilized),	Corn (Clark).
Plat 19 (fertilized),	Corn (Clark).
Plat 20 (unfertilized),	Corn (Clark).
Plat 21 (fertilized),	Corn (Clark).

RESULTS OF EXPERIMENTS WITH CORN.

Analysis of Green Fodder Corn.

		Plat 17. (Fertilized.)	Plat 18. (Unfertilized.)
1884.			
July 25. At the beginning of Blooming,	Moisture at 100° C.,	87.62	85.15
	Dry Vegetable Matter,	12.38	14.85
Sept. 1. Kernels in Milk,	Moisture at 100° C.,	72.27	78.77
	Dry Vegetable Matter,	27.73	21.23

Fertilized Plats, $\frac{1}{10}$ of an acre each,	Plat 17, 4,340 lbs. Plat 19, 3,096 lbs.	Total yield, 7,436 lbs.
Unfertilized Plats, $\frac{1}{10}$ of an acre each,	Plat 18, 2,460 lbs. Plat 20, 2,556 lbs.	Total yield, 5,016 lbs.
Yield of Fertilized Plats, per acre,		37,180 lbs.
Yield of Unfertilized Plats, per acre,		25,080 "
Difference in yield,		12,100 lbs.

Composition of Dry Vegetable Matter in Corn Fodder (fertilized).

Crude Ash,	3.16 parts.
Crude Cellulose,	24.32 "
Crude Fat,	2.89 "
Crude Protein,	9.64 "
Non-nitrogenous Extract Matter,	59.99 "

During the year 1885, plats Nos. 17, 18, 19, 20 and 21 served again, as in previous years, for the cultivation of corn. The crop raised upon the fertilized plats Nos. 17, 19 and 21 was used in part for ensilage; that obtained from the unfertilized plats Nos. 18 and 20 was sold as dry fodder corn; both crops were cut at the same time to compare results.

The entire crop upon all plats was cut Sept. 4, 1885. The dry corn fodder secured from the fertilized plats averaged $5\frac{1}{6}$ tons per acre, and that from the unfertilized plats in this connection yielded $3\frac{1}{10}$ tons for the same area. The fertilized plat No. 13 produced 1,870 pounds of dried millet, or 18,700 pounds ($9\frac{1}{3}$ tons) per acre; and the unfertilized plat No. 14 (for three succeeding years without manure) produced 1,050 pounds of air-dried crops, or 10,500 pounds ($5\frac{1}{4}$ tons) for a corresponding area.

The plats 11, 12, 15 and 16 (Field B), which had been seeded down broadcast, during the month of September, 1884, with several varieties of grasses for the purpose of studying their individual nutritive character at different successive stages of growth, became soon infested with all kinds of plants. As this circumstance could not otherwise than quite seriously interfere with our object, it was thought best to replough these plats and *to seed* down again *each variety* of *grass, in drills.* The cultivation of grasses in drills, two feet apart, was adopted with much success June 22, 1885. A frequent use of the cultivator, aided by the hoe and the weeding by hand, has enabled us to secure a suitable material for examination during last summer, 1886.

No material changes have been made of late in the general arrangement and mode of treatment of the plats in Field B, beyond the addition of an area of forty-three feet in length and of a corresponding width of the existing plats on the west end of each individual plat. This addition makes the present length of these plats 175 feet; they are each 33 feet wide (see sketch of Field B in 1886). The same varieties of grasses and of corn (Clark) were cultivated. The latter was also planted, in place of two varieties of millets during the preceding year, in plats 13 and 14. The corn was planted, as in previous years, in drills three feet three inches apart; the seed was dropped, from six to eight in a place, at a distance of from twelve to fourteen inches apart, May 17, 1886. Plats 13, 17, 19 and 21 were fertilized with ground bones and potash, as in preceding years, while plats 14, 18 and 20 received no manurial matter of any description. The growth of the corn on fertilized and unfertilized plats presented throughout the season a similar appearance, as has been noticed and described on previous occasions, with the exception of the fertilized plat 13 and the unfertilized plat 14, which yielded a larger return than any other of the plats under a corresponding treatment. These two plats had been changed from the cultivation of corn in 1883 to that of millet in 1884 and 1885. They were evidently left in a better condition for the raising of fodder corn in 1886 than the remaining plats which had been used for the production of fodder corn, without any interruption since 1883.

The corn on all plats was cut September 9 and 10, when the kernels began to glaze. The produce of the fertilized plats 13, 17, 19 and 21 was turned into corn ensilage, and that of the unfertilized plats 14, 18 and 20 was stooked in the field until October 12, when it was housed in common with the dried fodder corn obtained from the under-drained plats of Field A, described in the previous pages.

Amount of Green Fodder Corn obtained on Fertilized Plats per Acre.

Plat 13.	Green fodder corn for silo,	35,410 lbs.,	or	17.75	tons.
Plat 17.	" " "	27,310	"	13.65	"
Plat 19.	" " "	28,290	"	14.15	"

Amount of Dry Fodder Corn obtained on Unfertilized Plats per Acre.

Plat 14.	Dry fodder corn,	6,200 lbs.,	or	3.1	tons.
Plat 18.	" "	4,500	"	2.25	"
Plat 20.	" "	3,000	"	1.5	"

The grasses upon plats 11, 12, 15 and 16 looked well in the spring. The difference in their general appearance, between the fertilized plat 11 and the unfertilized plat 16, and the unfertilized plat 12 and the fertilized plat 15, was less marked than in the case of the corn; it became, however, quite striking as the season advanced. The growth upon the fertilized plats was in each case denser, taller and of a deeper color at the time of cutting for hay than for rowen. The Orchard grass was in bloom from four to five days earlier (June 7) than the Meadow Fescue (June 12). The Timothy (Herd's grass) bloomed June 28, about one week earlier than the Redtop, July 5. The grasses on plats 11 and 12 were cut July 5, and those on plats 15 and 16 July 11.

The fertilized plat 11 yielded 560 lbs. of hay (Orchard and Fescue).
The unfertilized plat 12 yielded 510 lbs. of hay (Orchard and Fescue).
The fertilized plat 15 yielded 690 lbs. of hay (Timothy and Redtop).
The unfertilized plat 16 yielded 550 lbs. of hay (Timothy and Redtop).

From this statement it will be noticed that —

Plat 11	yielded	hay at the	rate	of	2.1	tons	per acre.
Plat 12	"	"	"	"	1.9	"	"
Plat 15	"	"	"	"	2.59	"	"
Plat 16	"	"	"	"	2.06	"	"

The result is remarkable, considering that the rows of grass were two feet apart, leaving thus one-half of the area of the land unoccupied by the crop. The second growth (rowen) was not less satisfactory than the first; it was cut September 13 and 14.

The fertilized plat 11 yielded 225 lbs. of rowen (Orchard and Fescue).
The unfertilized plat 12 yielded 185 lbs. of rowen (Orchard and Fescue).
The fertilized plat 15 yielded 230 lbs. of rowen (Timothy and Redtop).
The unfertilized plat 16 yielded 175 lbs. of rowen (Timothy and Redtop).

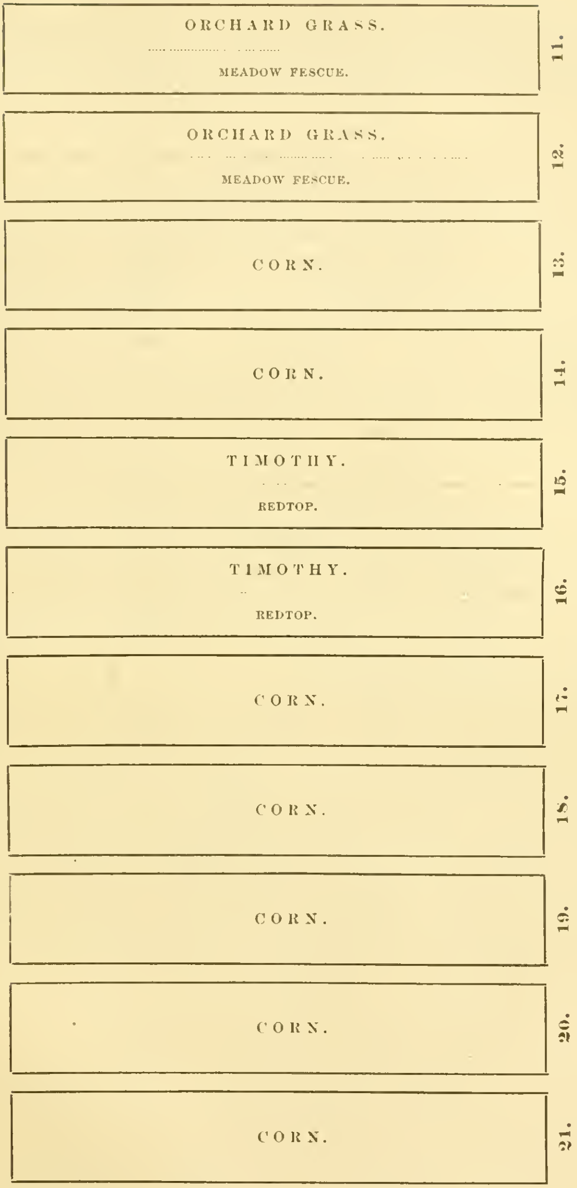
It may be seen from this that —

Plat 11	yielded	rowen	at the rate	of	.84	tons	per acre.
Plat 12	"	"	"	"	.69	"	"
Plat 15	"	"	"	"	.86	"	"
Plat 16	"	"	"	"	.65	"	"

The cultivation of grasses in drills renders a satisfactory harvesting of the crop quite troublesome, on account of the liability of a large admixture of soil in the dried crop under ordinary modes of management.

Samples of the various kinds of grasses on trial have been collected at successive stages of their growth to ascertain their respective relative nutritive value. The results of these analytical-chemical investigations will be published as soon as the work has sufficiently advanced to admit of an intelligent presentation.

FIELD "B," IN 1886.


ORCHARD GRASS.
MEADOW FESCUE.
11.
ORCHARD GRASS.
MEADOW FESCUE.
12.
CORN.
13.
CORN.
14.
TIMOTHY.
REDTOP.
15.
TIMOTHY.
REDTOP.
16.
CORN.
17.
CORN.
18.
CORN.
19.
CORN.
20.
CORN.
21.

Corn and Grass Plats. Scale, 4 rods to 1 inch. 1886.

The dotted line indicates the addition made to the original area of one-tenth of one acre in each plat during the fall of 1885.

4. EXPERIMENTS WITH THE CULTIVATION OF FODDER CROPS TO FURNISH A CONTINUOUS SUPPLY OF SUITABLE GREEN FODDER FOR DAIRY STOCK DURING THE SUMMER SEASON.

[Field C.]

The experiment was planned chiefly for the purpose of ascertaining the area required for the cultivation of each of the following crops, oats, vetch, serradella and Southern cow-pea, when serving in the stated succession as green fodder for the support of a definite number of milch cows, from the beginning of July to the middle of September. These crops, which have been already described more or less in detail in previous reports, were noticed to attain upon our grounds a suitable state of growth for feeding purposes at such succeeding periods of the season as promised to meet the requirements of the object in view. The feeding of each crop began when it had reached the stage of blooming, and it was discontinued when it approached its maturity. Some coarse, dry fodder, consisting mainly of hay of oats cut the previous year, was fed with the green fodder, to regulate its action on the digestive organs.

The practice of raising a greater variety of valuable crops, like those previously stated, for green fodder deserves the serious consideration of farmers engaged in the dairy business; for it secures a liberal supply of healthy, nutritious fodder at a time when hay becomes scarce and costly, and when it would be still a wasteful practice to feed an imperfectly matured green fodder-corn. The frequently limited area of land fit for a remunerative production of grasses, and the not less recognized exhausted condition of a large proportion of natural pastures, makes it but judicious to consider seriously the means which promise not only to increase, but also to cheapen, the products of the dairy. A liberal introduction of reputed fodder crops into farm operations has everywhere in various directions promoted the success of agricultural industry. The field assigned for the raising of oats, vetch and Southern cow-peas was 240 feet long and 90 feet wide; it was divided into three equal parts, each 30 feet wide and 240 feet long. The serradella covered an area 85 feet long and 56 feet wide. The soil consisted of a good loam, and was in a fair state of cultivation. The fertilizers used consisted of six hundred pounds of fine-ground bones and one hundred and fifty pounds of muriate of potash per acre. The different crops were cultivated in drills three feet three inches apart; they proved, without exception, a success.

Oats. — The variety raised in this connection was secured in our vicinity. Its particular name is somewhat uncertain; it grows quite tall, and forms thickly-leaved stems; the grain is of a good average size and weight. The oats were sown May 3; the young plants appeared May 12; they began to bloom July 5. The feeding of the green oats commenced that day, and was continued for about two weeks, until July 20, when the plants turned yellowish. Forty pounds were fed per day to each cow.

Composition of Green Fodder Oats.

	1886.		
	July 5.	July 12.	July 20.
	Per cent.	Per cent.	Per cent.
Moisture at 100° C., ...	78.61	71.18	66.04
Dry Matter, ...	21.39	28.82	33.96

The composition of our variety of oats at the time of feeding may be inferred from the following analysis of a sample raised on the same ground in 1885 and published in the last annual report: —

HAY OF OATS.

[From Plats of Station, cut while in Milk, July 9, 1885.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	9.55	191.00	–	–	1 : 7.9
Dry Matter,	90.45	1,809 00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	6.08	121.60	–	–	
" Cellulose,	34.32	686.40	–	–	
" Fat,	2.69	53.80	24.75	46	
" Protein (Nitrogenous Matter),	10.89	217.80	124.15	57	
Non-nitrogenous Extract Matter,	46.02	920.40	920.40	100	
	100.00	2,000.00	1,069 30	–	

Vetch (Vicia sativa). — The seed was imported to secure the same variety of vetch which had been tried here in previous years. It was sown May 14, and made its first appearance May 19. The growth was kept clean by frequent use of the cultivator. The latter was first used May 24, when the young plants had reached a height of two inches. The first signs of blooming were noticed July 6. The feeding of the green crop commenced July 20, and was continued until August 2. Twenty-five pounds were used in the daily diet per head. A second crop was cut September 13. The vetch yields a large and valuable growth, yet seems best adapted for green fodder when raised as a mixed crop with oats, barley or rye Clear green vetch is not as much relished at the beginning by dairy cows as the mixed crop.

Composition of Green Vetch.

[July 19, 1886.]

	Per cent.
Moisture at 100° C.,	82.97
Dry Matter,	17.03

The subsequent copies of two analyses of vetch raised on our own grounds in previous years may convey some more definite idea regarding the composition of this reputed fodder crop: —

VETCH (HAY).

(VICIA SATIVA; VARIETY, ANGUSTIFOLIA.)

[I. Collected from Experimental Plats, Aug. 15, 1883, in bloom.]

I.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	8.35	167.00	–	–	1 : 4.02
Dry Matter,	91.65	1,833.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	7.97	159.40	–	–	
“ Cellulose,	30.68	613.60	331.34	54	
“ Fat,	2.30	46.00	27.60	60	
“ Protein (Nitrogenous Matter),	15.76	315.20	239.55	76	
Non-nitrogenous Extract Matter,	43.29	865.80	562.77	65	
	100.00	2,000.00	1,161.26	–	

VETCH (HAY).

[II. Collected from Experimental Plats, Sept. 3, 1883, when fully matured.]

II.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	9.45	189.00	–	–	1 : 4.09
Dry Matter,	90.55	1,811.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	8.50	170.00	–	–	
“ Cellulose,	30.05	601.00	270.45	45	
“ Fat,	2.69	53.80	32.28	60	
“ Protein (Nitrogenous Matter),	14.42	288.40	204.76	71	
Non-nitrogenous Extract Matter,	44.34	886.80	487.74	55	
	100.00	2,000.00	995.23	–	

Serradella (Ornithopus sativus, Brot.). — The special agricultural value of this plant has been pointed out in a previous report. The successful cultivation upon the fields of the Station in preceding years encouraged its trial as a green fodder in connection with the experiment under discussion. The seed was planted May 12; the young plants showed themselves May 20; they commenced blooming July 13. The feeding of green serradella began August 3 and was discontinued the 24th of that month. At first twenty-five pounds, and subsequently from thirty to thirty-five pounds, formed part of the daily diet of each cow on trial. The green serradella is highly relished by the dairy cows, and has evidently a very beneficial influence on the yield of milk.

Composition of Green Serradella.

[August 4, 1886.]

	Per cent.
Moisture at 100° C., ...	84.60
Dry Matter, ...	15.40

The subsequent two analyses of samples raised here in previous years are republished in this connection to show the general character of this valuable fodder plant.

SERRADELLA (HAY).

(ORNITHOPUS SATIVUS, BROT.)

[I. Obtained from plats of the Station when blooming, Aug. 14, 1883.]

I.

	Percentage Composition.	Constituents (in lbs) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C., . . .	7.20	144.00	–	–	1 : 4.72
Dry Matter, ...	92.80	1,856.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash, ...	5.87	117.40	–	–	
" Cellulose, ...	24.37	487.40	–	–	
" Fat, ...	2.37	47.40	28.44	60	
" Protein (Nitrogenous Matter), ...	17.85	357.00	224.91	63	
Non-nitrogenous Extract Matter, ...	49.54	990.80	990.80	100	
	100.00	2,000.00	1,244.15	–	

SERRADELLA (HAY).

[II. From plats of Station, collected Sept. 3, 1883, when fully matured.]

II.

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	8.70	174.00	–	–	1 : 5.47
Dry Matter,	91.30	1,826.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	6.46	129.20	–	–	
" Cellulose,	25.14	502.80	236.32	47	
" Fat,	2.91	58.20	29.10	50	
" Protein (Nitrogenous Matter),	15.26	305.20	183.12	60	
Non-nitrogenous Extract Matter,	50.23	1,004.60	693.17	69	
	100.00	2,000.00	1,141.71	–	

Southern Cow-pea (Dolichos?); variety, Whippoorwill Pea. — The seeds were obtained of J. Wolfenden, provision dealer, in Newbern, N. C., who kindly furnished us with seeds in previous years. The general characteristics of this valuable Southern fodder-plant have been pointed out in the Second Annual Report of the Experiment Station, 1884, pages 91–93. The seed was sown May 14; the young plants were first noticed May 25; they made slow progress until July 15, when they began to develop more rapidly; they reached, August 14, a height of from one and one-half to two feet, and formed a dense growth of deep green vines. The green cow-pea was fed from the 24th of August to the 15th of September, 1886, beginning with 24 pounds per day and increasing gradually the amount to 40 pounds in the daily diet. Several cows served in the experiments; the daily fodder rations per head were compounded in the following manner: —

Composition of Green Cow-pea.

[August 24, 1886.]

	Per cent.
Moisture at 100° C.,	83.00
Dry Matter,	17.00

COW-PEA (HAY).

(VARIETY: WHIPPOORWILL.)

[From Experimental Plats of Station; collected Aug. 1, 1883.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	9.65	193.00	–	–	1 : 4.74
Dry Matter,	90.35	1,807.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	10.46	209.20	–	–	
" Cellulose,	22.36	447.20	210.18	47	
" Fat,	3.87	77.40	45.67	59	
" Protein (Nitrogenous Matter),	16.95	339.00	203.40	60	
Non-nitrogenous Extract Matter,	46.36	927.20	639.77	69	
	100.00	2,000.00	1,099.02	–	

The feeding of green cow-pea ceased on account of limited supply. The vines grow until late in the season; they stand our autumn weather extremely well.

Feed in Pounds per Day.

	1886.					
	June 24 to July 5.	July 6 to July 20.	July 21 to Aug. 3.	Aug. 4 to Aug. 24.	Aug. 25 to Sept. 26.	Sept. 27 to Oct. 14.
Corn Meal,	3.25	3.25	3.25	3.25	3.25	3.25
Wheat Bran,	3.25	3.25	3.25	3.25	3.25	3.25
English Hay,	20.00	–	–	–	...	8.00
Hay of Oats (1885),	–	10.00	10.00	10.00	10.00	–
Green Oats,	–	40.00	–	–	–	–
Green Vetch,	–	–	25.00	–	–	–
Green Serradella,	–	–	–	35.00	–	–
Green Cow-pea,	–	–	–	–	30.00	40.00

As our supply of hay of oats (1885) gave out at the beginning of September, a small amount of English hay was substituted. The feeding of green fodder crops with an addition of a coarse, dry fodder has a good effect on the general condition of the animal. Hay of oats is best chopped for that purpose. A temporary increase of bran, oilcakes, gluten meal and fodder articles of a similar composition instead of corn meal suggests itself in this connection as an improvement on our daily fodder rations during a first trial.

Taking our mode of cultivation into consideration, it seems advisable to cultivate for the supply of one cow, for the period of time above stated, an area of from 5,000 to 5,500 square feet of oats, and from 7,000 to 7,500 square feet each of vetch, serradella and cow-pea. In case oats and vetch are to be raised as a mixed crop, 12,000 square feet might be the limit. The oats mature too rapidly to answer for more than two weeks as a green fodder.

The field (C) turned to account for the purpose described above is in a first-class condition for the cultivation of winter grains, as far as time of seeding, clean cultivation and special accumulation of plant food is concerned. Vetch, serradella and cow-pea belong to the valuable family of *Leguminosæ;* they, like the clover, enrich the soil in the interest of grain crops. A variety of wheat occupies at present the area.

An analysis of the hay of oats used in our feeding experiment has been stated on a previous page; that of English hay follows here: —

HAY.

[From Station Fields, 1885.]

	Percentage Composition.	Constituents (in lbs.) in a ton of 2,000 lbs.	Pounds Digestible in a ton of 2,000 lbs.	Per cent. of Digestibility of Constituents.	Nutritive Ratio.
Moisture at 100° C.,	8.30	166.00	–	–	1 : 9.5
Dry Matter,	91.70	1,834.00	–	–	
	100.00	2,000.00	–	–	
Analysis of Dry Matter.					
Crude Ash,	6.12	122.40	–	–	
" Cellulose,	30.19	603.80	350.20	58	
" Fat,	2.55	51.00	23.46	46	
" Protein (Nitrogenous Matter),	9.75	195.00	111.15	57	
Non-nitrogenous Extract Matter,	51.39	1,027.80	647.51	63	
	100.00	2,000.00	1,132.32	–	

5. EXPERIMENTS WITH POTATOES.

VAR.: BEAUTY OF HEBRON.

The experiments carried on in this connection are at present conducted for the following purpose: —

First, To study the special effect, if any, of muriate of potash and of sulphate of potash on the quantity and quality of potatoes raised by their aid as the principal potash source of plant food.

Second, To ascertain the effect of planting whole potatoes and half potatoes, on the yield of the crop.

Third, To inquire into the causes of the production of scabby potatoes.

The first two objects of inquiry have received attention since 1884; the last-mentioned one has been added to our task during the past year, at the special request of the Franklin Harvest Club. The same piece of land has been used from the beginning of our field work (1884), as far as the first and second lines of observation are concerned; whilst a separate field was chosen for studying the behavior of "*scabby* potatoes" as "*seed* potatoes." As a short description of the course pursued in previous years cannot fail to assist in a due appreciation of the results of the past season, a few essential circumstances are in this connection republished from previous annual reports.

A. — *Experiments with High-grade German Potash Salts and Ground Bones as Fertilizers.*

1884. — Three plats, each one-fifth of an acre in size, were chosen for the experiment. The land had been for years in grass, and contained quite a number of old apple trees. The majority of the latter were removed, and the turf thoroughly broken up before manuring, during the spring of 1884.

Plat 1 (west end) received one hundred and twenty pounds of ground rendered bones and thirty pounds of muriate of potash (equal to from twenty-six to twenty-seven pounds of phosphoric acid, four to four and one-half pounds of nitrogen, and fifteen to sixteen pounds of potassium oxide).

Plat 2 received no manure of any kind.

Plat 3 (east end) received one hundred and twenty pounds of ground rendered bones, and fifty-eight pounds of double sulphate of potash and magnesia (equal to from twenty-six to twenty-seven pounds of phosphoric acid, four to four and one-half pounds of nitrogen, fifteen to sixteen pounds of potassium oxide, and five to six pounds of magnesium oxide).

The fertilizers were applied broadcast, and harrowed under before planting. The potatoes were planted in rows, three feet apart and fourteen inches distant in the drills, during the first week in May, 1884. The crop was kept clean from weeds by a timely use of the cultivator.

As an additional feature of the experiment, one-half of each plat was planted with medium-sized whole potatoes; the other with half potatoes obtained from a similar size.

The vines produced by whole potatoes showed a more vigorous growth during the main part of the season than those by part of a potato. The entire field looked promising until towards the middle of August, when with the appearance of the blight the life of the stems and leaves prematurely terminated.

The crop was harvested on the 9th and 10th of September. (See results farther on.)

Analyses of Potatoes (1884).

One hundred parts of air-dried fresh potatoes contained : —

	From Plat 1.	From Plat 2.	From Plat 3.
Dry Vegetable Matter, ...	19.39	23.30	21.52
Water, ...	80.61	76.70	78.48
	100.00	100.00	100.00

A well-matured potato contains on an average, approximately, twenty-five per cent. of solid matter. The unmatured potatoes were evidently more advanced in growth, whilst those manured with muriate of potash were least advanced in that direction.

The latter, on the other hand, had the smoothest skins, and were *almost entirely free from scab, which seriously disfigured those from Plats 2 and 3.*

1885. — The arrangement of the field, the mode of manuring, and the variety of the potatoes raised was the same as in the preceding season. The same three plats served for the experiment, each one-fifth of an acre in size; the potatoes were planted April 27. Plat No. 1 received, as fertilizer, thirty pounds of muriate of potash and one hundred and thirty pounds of steamed fine-ground bones; Plat No. 2 received no fertilizer; Plat No. 3 was fertilized with fifty-eight pounds of potash-magnesia sulphate and one hundred and twenty pounds of fine ground bones. The rows were three feet three inches apart, and the seed potatoes dropped from eighteen to twenty-four inches in the row. One-half of each plat was planted with medium-sized whole potatoes; one-half with half a potato in a spot. The seed potatoes used had been carefully selected from our own crop raised during the preceding season on the same plats.

The young crop was hoed June 9. The difference in the plats was quite marked July 24; plat (No. 1) with muriate of potash had the largest foliage and looked darker green than the remainder; that with potash sulphate (No. 3) looked next best. A *blight on the leaves*, which showed itself during the first week of August, prematurely terminated the experiment; the vines upon all plats died soon after. The crop was harvested August 26. (See results farther on.)

The potatoes from all the plats suffered severely from scab.

As the increase of vegetable matter in the young plant indicates the progress of their growth, it was decided to determine, from time to time, the actual amount of vegetable matter in a given weight of the more advanced tubers, by carefully expelling the water present, at a temperature of from 100° to 110° C.

A well-matured potato contains, as has been stated before, on an average twenty-five per cent. of solid matter.

The subsequent statements are the results of our examination.

Determination of Solids in Potatoes.

JULY 24.

	From Plat No. 1.	From Plat No. 2.	From Plat No. 3.
Moisture at 100° C.,	81.44	79.49	79.39
Solids,	18.56	20.51	20.61
	100.00	100.00	100.00

AUGUST 5.

	From Plat No. 1.	From Plat No. 2.	From Plat No. 3.
Moisture at 100° C.,	80.96	81.04	79.36
Solids,	19.04	18.96	20.64
	100.00	100.00	100.00

AUGUST 27.

	From Plat No. 1.	From Plat No. 2.	From Plat No. 3.
Moisture at 100° C.,	79.85	80.60	80.61
Solids,	20.15	19.40	19.39
	100.00	100.00	100.00

The exceptionally large proportion of small potatoes obtained in particular from Plats Nos. 2 and 3, as well as the low percentage of solids in the potatoes tested, prove the premature termination of a healthful condition of the entire crop. The normal growth of the tubers came apparently to a standstill soon after the first examination for solids had been made (July 24, etc.). The results seemed to indicate a connection between "blight" and "scab"; and left scarcely any doubt about the circumstance, that either the one or the other, or both jointly, had contributed directly or indirectly towards the partial failure of the crop for the two succeeding seasons.

It was decided, in sight of these facts, to continue the experiments in 1886 upon the same field, with some modifications, to ascertain, if possible, whether the main influence regarding the results in our past observation had to be ascribed to atmospheric agencies, or to the condition of the soil and to the fertilizer applied or to the quality of the seed potato used.

1886.—The same field was used. The land was well prepared by plowing and harrowing April 27, and subsequently fertilized the same as in previous years. Plat 1 received broadcast, as before, a mixture of muriate of potash and fine-ground bones. Plat 2 received, as before, no fertilizer of any description. Plat 3 was again manured broadcast, with sulphate of potash and fine-ground bones. The change, regarding the character of the fertilizer applied, consisted in using nearly twice the amount of potash salts, muriate of potash and sulphate of potash for the same area in case of Plats 1 and 3. The increase in potash compounds was made to test their efficacy as a preventative of scab. A second important change from our previous practice consisted in securing first quality seed potatoes,—in particular, *free* from scab. The same variety—Beauty of Hebron—was obtained for that purpose from Vermont; it was as fair an article as could be desired. The system of planting and cultivating was the same as in previous years. The potatoes were planted upon all plats May 5, 1886; each plat had fourteen rows, with hills three feet apart in each direction. The young plants appeared evenly; the vines coming from whole potatoes, however, soon became heavier and taller than those coming from half potatoes, a peculiarity in their growth which remained noticeable during the entire season. All the vines were in full blossom July 6; they began to turn yellowish and to dry up July 30. The crop on the entire field was dried up August 8. This change seemed to appear most marked first on the vines from whole-seed potatoes. The entire crop was harvested August 28.

The experiment of the past season has been a serious failure, as far as the *quality* of the potatoes raised on any of the three plats is concerned. The entire crop, with scarcely any exception, was badly disfigured by scab; the potatoes were unfit for family use, and had to be sold at a low price for stock feeding.

Neither a liberal use of our own mixture of commercial manurial substances, rich in potash compounds, nor the selection of a fair quality of seed potatoes from another source, has affected our results as compared with those of the previous season. The successful raising of a *superior* potato from *scabby* seed potatoes upon another field of the Experiment Station, which will be described farther on in these pages, shows that the atmospheric peculiarities of the last summer season cannot have caused the above-reported failure. In sight of these circumstances it seems but natural to incline to the conclusion that some peculiar condition of the soil upon the lands occupied by this experiment has to be considered as the real seat of our trouble. The work will be continued until a more positive proof can be offered.

The subsequent tabular statement regarding certain features of the potato crop raised for three successive years upon the three experimental plats here under discussion are not without interest when considered in connection with the preceding remarks.

1884.

PLAT I.

SEED POTATO.	Fertilizer Applied.	Yield of Potatoes upon One-fifth of an Acre, in Pounds.		
		Large.	*Small.*	*Total.*
Whole Potato, .	120 lbs. ground bones and 30 lbs. muriate of potash.	1,085	460	1,545
One-half a Potato, .		1,140	335	1,485
		2,225	795	3,030

PLAT II.

		Large.	*Small.*	*Total.*
Whole Potato, .	Not fertilized.	830	280	1,110
One-half a Potato, .		850	250	1,100
		1,680	530	2,210

PLAT III.

		Large.	*Small.*	*Total.*
Whole Potato, .	120 lbs. of bones and 58 lbs. potash-magnesia sulphate.	1,120	342	1,462
One-half a Potato, .		930	105	1,035
		2,050	447	2,497

1885.

PLAT I.

SEED POTATO.	Fertilizer Applied.	Yield of Potatoes upon One-fifth of an Acre, in Pounds.		
		Large.	*Small.*	*Total.*
Whole Potato, .	120 lbs. ground bones and 30 lbs. muriate of potash.	705	355	1,060
One-half a Potato, .		695	270	965
		1,400	625	2,025

PLAT II.

		Large.	*Small.*	*Total.*
Whole Potato, .	Not fertilized.	335	350	685
One-half a Potato, .		255	270	525
		590	620	1,210

PLAT III.

		Large.	*Small.*	*Total.*
Whole Potato, .	120 lbs. of bones and 58 lbs. potash-magnesia sulphate	605	490	1,095
One-half a Potato, .		540	580	1,120
		1,145	1,070	2,215

1886.

PLAT I.

SEED POTATO.	Fertilizer Applied.	Yield of Potatoes upon One-fifth of an Acre, in Pounds.		
		Large.	*Small.*	*Total.*
Whole Potato, .	100 lbs. ground bones and 50 lbs. muriate of potash.	410	592	1,002
One-half a Potato, .		431	188	620
		841	780	1,622

Plat II.

Seed Potato.	Fertilizer Applied.	Yield of Potatoes upon One-fifth of an Acre, in Pounds.		
		Large.	*Small.*	*Total.*
Whole Potato, .	Not fertilized.	321	398	719
One-half a Potato, .		353	194	545
		674	592	1,264

Plat III.

		Large.	*Small.*	*Total.*
Whole Potato, .	100 lbs. ground bones and 96 lbs. potash-magnesia sulphate.	747	503	1,250
One-half a Potato, .		658	315	974
		1,405	818	2,224

A careful study of the above tables leads to the following conclusions: —

1. Medium-sized whole potatoes give better results than half potatoes obtained from tubers of a corresponding size.

2. Disregarding the results of the first year, when previously existing liberal resources of plant food are apt to render the influence of an additional supply of manurial substances less marked, it appears that the sulphate of potash produced better results in our case than the muriate of potash.

3. The premature dying out of the vines, accompanied by blight or scab, or both, must be considered a controlling cause of the exceptionally large proportions of small potatoes.

B. — *Observations with Scabby Potatoes.*

These experiments were inaugurated during the past season for the purpose of inquiring into the circumstances which control the development and the propagation of the "scab" on potatoes.

The first year's work in this connection has been confined to the task of observing the behavior of scabby potatoes as *seed* potatoes, under some definite previous treatment. To prevent a possible propagation of scab, by infected seed potatoes, to the new crop, the following course was adopted: Thoroughly scabby potatoes obtained from the previously-described experimental plats were treated with some substances known to be destructive to various forms of parasitic growth. This operation was carried out with the intention of destroying the propagating power of adherent germs of an objectionable character, before planting the potatoes.

The field for the observation was distinctly separate from other experimental plats for the cultivation of potatoes. It had been used for many years previous for the raising of grass, and had since been planted but once, — the preceding year, — with corn. The land was prepared by ploughing and harrowing, in the same way as other potato fields: it was fertilized broadcast with the same amount of fertilizer per acre as Plat No. 3, in 1884 and 1885, in the above-described experiment (A); namely, six hundred pounds of ground bones and two hundred and ninety pounds of potash-magnesia sulphate.

The field was subdivided into five plats of equal size, eighty feet long and fifty feet wide, and the potatoes subsequently planted in rows three feet three inches apart, with hills three feet from each other in the rows. Three feet of space was left unoccupied between the different plats. The scabby seed potatoes selected for the trial were, as far as practicable, of a uniform medium size. Each lot was immersed in the particular solution prepared for the different plats; after being kept there for twenty-four hours they were removed, and directly planted without any other operation.

Plat No. 1 (north end of field). The seed potatoes used in this case were smooth and healthy; they were planted without being subjected to any preparatory treatment. This course was adopted to learn whether soil, fertilizer or atmospheric agencies of the season would favor the appearance of the scab in the crop.

Plat No. 2. The potatoes were allowed to remain for twenty-four hours in a saturated solution of muriate of potash before being planted.

Plat No. 3. A strong solution of hypochlorite of lime (bleaching lime) was applied in a similar way for the preparation of the seed potatoes as in Plat No. 2.

Plat No. 4. A saturated solution of carbolic acid in water served in this instance for the treatment of the seed potatoes.

Plat No. 5. The seed potatoes used in this plat were treated, previous to planting, with a strong abstract by cold water of "The Potato Protector" of John Butterworth & Co., Mansfield, Mass. This material was sent to the Station, for an opinion regarding its merits, at a time when active preparations were under way to test by field experiments whether substances like those above stated would prove efficient to prevent the propagation of "scab" by seed potatoes. The practice of treating wheat and other seeds for similar purposes with solutions of sulphate of copper, etc., is not uncommon in other localities. As the "Potato Protector" proved to contain quite a noticeable quantity of a powerful agent, hypochlorite of lime, it was thought best to introduce the material into our experiment, instead of offering a mere opinion regarding its merits. The results of an examination into the composition of the "Potato Protector" are published with some comments at the close of this chapter.

The potatoes were planted in all plats on the same day, May 7, 1886; the young vines appeared on Plats 1 and 5, May 25, whilst on Plats 2, 3 and 4 they did not show themselves before the 29th of May, and not as generally and evenly as on Plats 1 and 5. This difference in growth could be noticed until towards the close of June, when the vines on all plats looked equally vigorous and thrifty. The vines on all the plats were, at this stage, vigorously attacked by the potato bug, and were protected against their destructive influence by a repeated sprinkling with a solution of Paris green. They began to bloom July 6. The vines on Plat 1 began first to turn yellow and to dry up July 30; those on the remaining plats began to change in a similar way August 8. The tops on all the vines were pretty generally dried up August 18. The potatoes were harvested on the entire field August 30. The yield on all plats was fair and the quality of the potatoes, almost without exception, excellent; this seemed to be most striking in regard to those from Plats 2, 3 and 4, which had been in the beginning of the season somewhat behind in growth. Here and there could be seen a potato with a small mark of scab; a large proportion were perfectly smooth and without any sign of it.

These results are recorded merely as those of a first experiment. They are, however, not without some interest when considered in connection with previous observations. The fact that a scabby potato may produce, under certain circumstances, a smooth and otherwise excellent potato must be accepted. The recognition of this fact does not, however, entitle us to the conclusion that it is a safe course to advise planting scabby potatoes with the expectation of raising a superior, healthy potato, without awaiting the results of a repetition of the experiment under modified circumstances. Good potatoes have been raised before from seed potatoes suffering from scab without any previous treatment similar to ours. Without any intention of anticipating the results of future observations, or to point out with certainty the exact cause of the results, we feel inclined to consider a difference in the condition of the soil on our old and new experimental potato plats, the real seat of our troubles ; for the former yielded most inferior, scabby potatoes, whilst the latter produced a most superior, smooth potato under otherwise identical conditions as far as soil, mode of cultivation and kind of fertilizer, upon land in close proximity, during the same season.

Potato Protector.

The material consisted of a brownish mixture of organic and earthy substances, which smelled strongly of hypochlorous acid. It deflagrated violently at red heat, and left 35.40 per cent. of crude ash, which contained 12.40 per cent. of chlorine, 14.15 per cent of calcium oxide and 0.11 per cent. of phosphoric acid, the rest being silicious matter.

A watery solution was dark-colored and smelled like a decoction of some herb, possibly the Bone-set (*Eupatorium perfoliatum*). A solution of some whitish substances it contained quickly decolorized an indigo solution.

From the above observation it appears that the substance is a mixture of some herbaceous matter with hypochlorite of lime (bleaching lime) as a prominent constituent.

The claim of the manufacturer is stated in the subsequent copy of a circular sent on with the material for our examination : —

To Farmers and Gardeners.

GENTLEMEN: — Permit me to call your attention to the remedy for the Potato Bug scourge, called "The Potato Protector."

It is non-poisonous, cheap, easy of application, and effective. It is composed mostly of vegetable substances, which are warranted not to poison man or beast. For twenty-five cents you can buy enough of it to treat one bushel of seed, and it is warranted to be a cheaper protector for the amount of land this seed will plant than a *single* application of Paris Green would be, and ordinarily a second and third application of the poison has to be made to protect the plants. But the *method of applying the Protector is its strong point*. The strength of one package of the Protector is transferred to five gallons of water, according to directions on each package; in this solution one bushel of seed potatoes, cut and ready to plant, is soaked for one-half hour. The plants from seed thus treated will be so distasteful to the bugs, both young and old, that they will not molest them, and the flavor of the Protector, so distasteful to the bugs, *is warranted not to be perceptible in the potatoes.* Thus by a single treatment, that may be done at the rate of a bushel an hour, without expensive help, the same results are secured at one-tenth the labor of applying Paris Green.

One season's trial will convince you that the Protector will keep the bugs off. The inventor, Mr. John Butterworth, after six years' experimenting, hit upon the Protector in 1884. That season it alone, of many others, stood the test, and in 1885 its value was confirmed by treating alternate hills, when the hills not treated were destroyed, and slugs and winged bugs placed on the treated hills would not feed or remain there.

JOHN BUTTERWORTH & CO.,
Mansfield, Mass.

Our experiment does not confirm the claim of the manufacturer, for potato bugs were as plenty on the vines of the potatoes treated in the above-described manner by a solution of "the Potato Protector" as on any other of our different experimental potato plats. Aside from this fact, it is but an act of justice to the manufacturer to state that he invited by letter an actual investigation on our part into his claim.

We should not, however, advise the preparation of a mixture of hypochlorite of lime, or bleaching lime, with herbaceous matter, if we did intend to turn the peculiarity of the former to account, for in that case it soon suffers serious alterations in its composition.

6. MISCELLANEOUS FIELD EXPERIMENTS WITH FARM AND GARDEN CROPS.

The field observations recorded under the above heading are made, in the majority of cases, on a comparatively limited scale. The supply of the seeds was, in many instances, quite small; some of them have been sent on by the United States Department of Agriculture in Washington, D. C. The work carried on in this connection has had, for obvious reasons, no other aim than to study either the adaptation of some new field crop to our climate, or to compare some new variety of a prominent garden crop with those frequently raised in our section of the State. The field set aside for these experiments was in a good state of cultivation. Barnyard manure, supplemented by commercial phosphates and potash compounds, had been used in the past as manure; no alteration was made in this respect during the past season. The different crops were seeded down in drills three feet three inches apart, and subsequently kept clean by a frequent use of the cultivator.

1. *Cleveland's Rural New Yorker Pea* (Pisum). — The seed was planted May 8; the young plants appeared May 17; they bloomed June 14. The first crop was ready for table use July 1. The fully matured vines had from five to six well-filled pods. Three rows forty feet long produced eight pounds of air-dried vines and six and one-half pounds of air-dried peas.

2. *Cleveland's Alaska Pea.*— The seeds were planted May 8; the young plants appeared May 19; they began to bloom June 14, and the first crop for table use was ready July 1. Each matured vine had from five to six well-filled pods. Three rows forty feet long yielded eight pounds of air-dried vines and six pounds of air-dried peas.

3. *Champion of England Pea.* — The seed was planted May 8; the young plants made their appearance May 20; they showed the first flowers June 28. The first crop for the table was ready July 15; they ceased growing August 7. Three rows forty feet long produced twenty-three pounds of air-dried vines and three and one-half pounds of air-dried peas.

4. *Marrowfat Peas.* — The seeds were planted May 8; the young plants appeared May 20; they showed their first blossoms July 5, and the first crop was ready for table use July 17; the

vines ceased growing and began dying out August 7. Three rows forty feet long yielded twenty-five pounds of air-dried vines and three and one-half pounds of air-dried peas.

The weights of the vines and peas were taken on the same day, three to four months after storing.

5. *Cleveland's Improved Valentine Beans* (Phaseolus).—The seeds were planted May 8; they appeared above ground May 22 and began blooming July 5; the beans reached their full size and the pods turned yellow August 10. The air-dried vines weighed twenty-six and one-half pounds; the air-dried beans twelve pounds.

6. *Horse Bean* (Vicia faba). — Three varieties of this fodder plant were raised during the past year with much success. A description of some varieties of this reputed fodder plant has been published in our previous report. Its adaptation to our soil, as well as its special agricultural value for green manuring, and for the production of a valuable bean for feeding purposes, has been discussed in that connection. Our attention during the past season was mainly directed towards the question, What proportion of the entire matured crop consists of straw and empty pods, and what of beans? The results of this inquiry are stated below.

Small horse bean. The seeds were planted May 12; the young plants appeared May 22; they began to bloom July 10, when two and one-half feet high; the first seeds formed August 13; the matured plants were cut and stooked September 13. Three rows forty feet long produced twenty pounds of air-dried straw and pods and twelve pounds of beans. The Jaeger bean, apparently but another name for small horse bean, yielded from the same area twenty pounds of air-dried straw and pods and fourteen and one-half pounds of air-dried beans. A larger variety of horse bean yielded, under similar circumstances, yet upon a larger area, two hundred pounds of air-dried beans and two hundred and seventy-five pounds of air-dried straw and pods, or for every ten pounds of dry beans thirteen and one-quarter pounds of dried straw and pods.

7. *Lupine.* — The white lupine (Lupinus albus) has been raised successfully for several years upon the fields of the Station. Its particular value as a green manure has been illustrated by experiment. During the last season two varieties

have been added to our experimental field for forage crops. Three varieties, the white, the yellow and the blue, are frequently cultivated by European agriculturalists. All are considered, more or less, a valuable addition to farm crops in general. The yellow variety is generally considered the most valuable of the three, for it is equally well fitted for green fodder or hay, or for green manure, and best adapted for a light, sandy soil, where clover cannot be raised with success. The seeds were planted May 12; the young plants were noticed May 22; they began blooming when two and one-half feet high, July 26; the seeds first formed August 7; the matured plants were cut September 11. The blue lupine produced three and one-half pounds of air-dried seeds to twelve and one-half pounds of air-dried stems and pods; the white and yellow varieties produced two pounds of air-dried seeds to twenty pounds of air-dried stems and pods.

Besides the above observations, small trials have also been made with the following seeds: —

Vicia villosa, } For sheep pastures.
Spergulum maximum, }
Sesame (Oil plant).
Pyrethrum roseum.
Some varieties of corn: *Pride of the North*, from Minnesota; *Browning Corn*, Springfield.
Some varieties of Texas grasses.
Alsike Clover.
Melilotus albus (Honey Lotus).
Lucerne (Alfalfa).
Some varieties of oats: *Harris Oats*, from Alabama, and *White Victoria Oats*, from Russia.
Melon Barley, from Russia.

Some of the results obtained in this connection are of sufficient interest to encourage further trials on a larger scale during the coming season. The new seeds of the varieties of oats and those of the new variety of barley especially are reserved for that purpose.

VALUATION OF FERTILIZERS, AND FERTILIZER ANALYSES.

The valuation of a fertilizer is based on the average trade value of the fertilizing elements specified by analysis. The money value of the higher grades of agricultural chemicals and of the higher-priced compound fertilizers, depends in the majority of cases on the amount and the particular form of two or three essential articles of plant food — *i. e.*, phosphoric acid, nitrogen and potash — which they contain. The valuation which usually accompanies the analyses of these goods informs the consumer, as far as practicable, regarding the cash retail price at which the several specified essential elements of plant food, in an efficient form, have of late been offered in our large markets.

The market value of low-priced materials used for manurial purposes, as salt, ashes, various kinds of lime, barnyard manure, factory refuse and waste materials of different descriptions, quite frequently does not stand in close relation to their chemical composition. Their cost varies in different localities. Local facilities for cheap transportation and more or less advantageous mechanical condition for a speedy action, exert, as a rule, a decided influence on their selling price.

The wholesale market price of manurial substances is liable to serious fluctuations; for supply and demand exert here, as well as in other branches of commercial industry, a controlling influence on their temporary money value. As farmers have only in exceptional instances a desirable chance to inform themselves regarding the conditions which control the market price, the assistance rendered in this direction by agricultural chemists charged with the examination of commercial fertilizers cannot otherwise but benefit, ultimately, both farmers and manufacturers.

The market reports of centres of trade in New England, New York and New Jersey, aside from consultations with leading manufacturers of fertilizers, furnish us the necessary information regarding the current trade value of fertilizing ingredients. The subsequent statement of cash values in the retail trade is obtained by taking the average of the wholesale quotations in New York and Boston during the six months preceding March 1, 1886, and increasing them by 20 per cent., to cover expenses for sales, credits, etc.

These trade values, except those for phosphoric acid, soluble in ammonium citrate, were agreed upon by the Experiment Stations of Massachusetts, Connecticut and New Jersey for use in their several States for the present season.

TRADE VALUES OF FERTILIZING INGREDIENTS IN RAW MATERIALS AND CHEMICALS.

	1886. Cents per Pound.
Nitrogen in ammonia salts,	18½
Nitrogen in nitrates,	18½
Nitrogen in dried and fine-ground fish,	17
Organic nitrogen in guano and fine-ground blood and meat,	17
Organic nitrogen in cotton seed, linseed meal, and in castor pomace,	17
Organic nitrogen in fine-ground bone,	17
Organic nitrogen in fine medium bone,	15
Organic nitrogen in medium bone,	13
Organic nitrogen in coarse medium bone,	11
Organic nitrogen in coarse bone, horn shavings, hair, and fish scraps,	9
Phosphoric acid, soluble in water,	8
Phosphoric acid, soluble in ammonia citrate,*	7½
Phosphoric acid, insoluble in dry, fine-ground fish and in fine bone,	7
Phosphoric acid, insoluble in fine medium bone,	6
Phosphoric acid, insoluble in medium bone,	5
Phosphoric acid, insoluble in coarse medium bone,	4
Phosphoric acid, insoluble in coarse bone,	3
Phosphoric acid, insoluble in fine-ground rock phosphate,	2
Potash as high grade sulphate,	5½
Potash as kainite,	4¼
Potash as muriate,	4¼

* Dissolved from two grams of phosphate, unground, by 100 cc. neutral solution of ammonia citrate, sp. gr. 1.09, in 30 minutes at 65 deg. C., with agitation once in five minutes, commonly called "reverted" or "backgone" phosphoric acid.

The above trade values are the figures at which, on March 1, 1886, the respective ingredients could be bought at retail for cash per pound in our leading markets in the raw materials, which are the regular source of supply.

They also correspond to the average wholesale prices for the six months ending March 1, plus 20 per cent in case of goods for which we have wholesale quotations. The calculated values obtained by the use of the above figures will be found to agree fairly with the reasonable retail prices in case of standard raw materials, such as —

Sulphate of Ammonia,
Nitrate of Soda,
Muriate of Potash,
Sulphate of Potash,
Dried Blood,
Dry Ground Fish,
Castor Pomace,
Cotton Seed,
Bone,
Azotin,
Plain Superphosphates.

TRADE VALUES IN SUPERPHOSPHATES, SPECIAL MANURES AND MIXED FERTILIZERS OF HIGH GRADE.

The organic nitrogen in these classes of goods are here valued at the highest figures laid down in the trade values of fertilizing ingredients in raw materials, namely, 17 cents per pound; it being assumed that the organic nitrogen is derived from the best sources, as bone, blood, animal matter, or other equally good forms, and not from leather, shoddy, hair or any low-priced inferior form of vegetable matter, unless the contrary is ascertained.

Insoluble phosphoric acid has been valued at 3 cents, it being assumed, unless found otherwise, that it is from bone or a similar source, and not from rock phosphate. In this latter form the insoluble phosphoric acid is worth but 2 cents per pound. Potash is rated at 4¼ cents per pound, if sufficient chlorine is present in the fertilizer to combine with it to make muriate.

If there is more potash present than will combine with the chlorine, then this excess of potash will be counted as sulphate. To introduce large quantities of chlorides, common salt, etc., into fertilizers, claiming sulphate of potash as a constituent, is a practice which, in our present state of information, will be considered of doubtful merit. The use of the highest trade values is but justice to these articles in which the costliest materials are expected to be used.

In most cases the valuation of the ingredients in superphosphates and specials falls below the retail price of the goods. The difference between the two figures represents the manufacturer's charges for converting raw materials into manufactured articles. These charges are for grinding and mixing, bagging or barrelling, storage and transportation, commission to agents and dealers, long credits, interest on investment, bad debts, and finally profits.

The prices stated in this report in connection with analyses of commercial fertilizers refer to their cost per ton of 2,000 lbs., on board of car or boat near the factory or place of general distribution. To obtain the valuation of a fertilizer (*i. e.*, the money-worth of its fertilizing ingredients), we multiply the pounds per ton of nitrogen, etc., by the trade value per pound. We thus get the values per ton of the several ingredients, and, adding them together, we obtain the total valuation per ton.

The mechanical condition of any fertilizing material, simple or compound, deserves the most serious consideration of farmers, when articles of a similar chemical character are offered for their choice. The degree of pulverization controls, almost without exception, under similar conditions, the rate of solubility, and the more or less rapid diffusion of the different articles of plant food throughout the soil.

The state of moisture exerts a no less important influence on the pecuniary value, in case of one and the same kind of substance. Two samples of fish fertilizer, although equally pure, may differ from 50 to 100 per cent. in commercial value, on account of mere differences in moisture.

Crude stock for the manufacture of fertilizers and refuse material of various descriptions sent to the Station for examination are valued with reference to the market prices of their principal constituents, taking into consideration at the same time their general fitness for speedy action.

A large percentage of commercial fertilizing material consists of refuse matter from various industries. The composition of these substances depends on the mode of manufacture carried on. The rapid progress in our manufacturing industries is liable to affect at any time, more or less seriously, the composition of the refuse. A constant inquiry into the character of the agricultural chemicals and of commercial manurial refuse substances offered for sale cannot fail to secure confidence in their composition, and to diminish financial disappointment in consequence of their application. This work is carried on for the purpose of aiding the farming community in a clear and intelligent appreciation of the substances for manurial purposes.

Consumers of commercial manurial substances do well to buy whenever practicable, on a guaranty of composition with reference to their essential constituents, and to see to it that the bill of sale recognizes that point of the bargain. Any mistake or misunderstanding in the transaction may be readily adjusted, in that case, between the contending parties. The responsibility of the dealer ends with furnishing an article corresponding in its composition with the lowest stated quantity of each specified essential constituent.

Connecticut Tobacco Stems.

[Sent on from South Deerfield, Mass.]

	Per cent.
Moisture at 100° C.,	10.65
Phosphoric acid (5 cents per pound),	0.51
Potassium oxide (4¼ cents per pound),	7.22
Calcium oxide,	3.39
Magnesium oxide,	1.12
Nitrogen (17 cents per pound),	2.65
Insoluble matter,	0.29
Valuation per 2,000 lbs.,	$14 66

The composition of the above sample corresponds well with that noticed on previous occasions. (See First Annual Report, page 103.)

The potash was almost entirely soluble in water at ordinary temperature; 6.85 parts of the entire amount present. The same feature was noticed in regard to the Havana tobacco stems.

Havana Tobacco Stems.

[Sent on from South Deerfield, Mass.]

	Per cent.
Moisture at 100° C.,	11.85
Phosphoric acid (5 cents per pound),	0 44
Potassium oxide (4¼ cents per pound),	6 62
Calcium oxide,	3.45
Magnesium oxide,	1.11
Nitrogen (17 cents per pound),	0.90
Insoluble matter,	1.35
Valuation per 2,000 lbs.,	$8 83

The amount of nitrogen in this sample of tobacco stems (Havana) is exceptionally low, about one-third of that found in other samples offered for sale in our section of the Connecticut River valley. (See Second Annual Report, page 138.) The difference in nitrogen causes the low valuation per ton, as compared with that of the preceding analysis. The sample was handed to us with the statement that it had been used for imparting the odor of Havana tobacco to other varieties. The odor had been removed apparently by a steaming process; for the mineral constituents, with the exception of the potassium oxide, corresponded fairly with those in the material described in our Second Annual Report. Farmers will do well to be careful in buying the article without stated guarantee of composition.

Hop Refuse.

[Sent on for examination from Lawrence, Mass.]

	Per cent.
Moisture at 100° C.,	80.98
Dry vegetable matter,	19.02
Nitrogen,	0.98
Calcium oxide,	0.27
Magnesium oxide,	0.10
Phosphoric acid,	0.20
Potassium oxide,	0.11
Insoluble matter,	0.63
Valuation per 2,000 lbs.,	$3 62

This refuse from breweries differs from the one previously described merely by a larger percentage of nitrogen it contains.

Supplemented by some phosphoric acid and potash it may serve in place of barnyard manure. The average barnyard manure (partly rotten) is usually stated to contain 0.5 per cent. of nitrogen, 0.26 per cent. of phosphoric acid and 0.6 per cent. of potassium oxide.

Rotten Brewers' Grain.

[Sent on for examination from Lawrence, Mass.]

	Per cent.
Moisture at 100° C.,	78.77
Dry vegetable matter,	21.23
Nitrogen,	0.72
Calcium oxide,	0.26
Magnesium oxide,	0.15
Phosphoric acid,	0 43
Potassium oxide,	0.04
Insoluble matter,	0.59
Valuation per 2,000 lbs.,	$2 71

The general character of the above-mentioned substance resembles that of barnyard manure. It contains more nitrogen and phosphoric acid, and less potash than the average barnyard manure. By increasing the latter ingredients to one-half a per cent. a fair substitute for barnyard manure may be obtained.

Glucose Refuse (dry).

[Sent on for examination.]

	Per cent.
Moisture at 100° C.,	8.10
Dry vegetable matter,	91.80
Nitrogen,	2.62
Phosphoric acid,	0.29
Magnesium oxide,	0.02
Calcium oxide,	0.18
Sodium oxide,	0.12
Potassium oxide,	0.15
Insoluble matter,	0.07
Valuation per 2,000 lbs.,	$9 33

This material consists mainly of the skins of corn ; it is evidently the insoluble residual matter left behind after the conversion of the starch into glucose syrup. The manurial value of the article rests mainly on the amount of nitrogen it contains in form of insoluble nitrogenous matter. To render it an efficient manure requires, in the majority of cases, a liberal addition of phosphoric acid and potash.

Damaged Cotton Seed Meal.

[Sent on from Greenfield, Mass.]

	Per cent.
Moisture at 100° C.,	9.90
Total phosphoric acid,	1.26
Potassium oxide,	1.21
Magnesium oxide,	0.56
Calcium oxide,	0.22
Nitrogen,	3.73
Insoluble matter,	0.20
Valuation per 2,000 lbs.,	$14 97

Analysis of Hen Manure.

[Sent on from Townsend, Mass.]

	Per cent.
Moisture at 100° C.,	8.35
Phosphoric acid,	2.02
Calcium oxide,	2.22
Magnesium oxide,	0.68
Potassium oxide,	9.94
Nitrogen in organic matter,	1.85
Nitrogen in actual ammonia,	0.28
Insoluble matter,	34.65
Valuation per 2,000 lbs.,	$10 55

The material was dry, and contained the usual mixture of feathers, short pieces of coarse vegetable matter, earthy substances, etc., yet not in an extraordinary degree. The value of the hen manure depends not less on the care which is bestowed on its keeping than on the kind of food the fowls consume. The excretion of birds, on account of their peculiar character, undergoes a rapid change; a large amount of ammonia is soon formed, which reduces materially its manurial value, in case it is allowed to escape. A liberal use of plaster, of kieserite or of good loam is highly recommendable for the absorption of the ammonia. The safest way to secure the full benefit of the droppings is to gather them quite frequently, and to add directly any of the previously-mentioned materials. A sandy soil is of little use as an absorbent.

Fresh Hen Manure.

[Sent on from Townsend, Mass.]

	Per cent.
Moisture at 100° C.,	45.73
Phosphoric acid (6 cents per pound),	0.47
Potassium oxide (4½ cents per pound),	0.18
Calcium oxide,	0.97
Nitrogen, total (17 cents per pound),	0.79
Insoluble matter, sand, etc.,	39.32
Valuation per 2,000 lbs.,	$3 42

This sample of fresh hen manure came from the same party who sent on the dry sample. It was inferior in quality as compared with the first material; it contained for the same amount of organic matter about twice as much worthless earthy matter. In a dry state, corresponding with the first sample, 8 per cent. of moisture, it would be worth only one-half as much, *i. e.*, about $5 per ton.

Ashes of Chestnut Railroad Ties.

[Sent on from Waltham, Mass.]

	Per cent.
Moisture at 100° C.,	6.15
Calcium oxide,	4.71
Magnesium oxide,	1.80
Potassium oxide,	0.19
Phosphoric acid,	1.54
Insoluble mineral matter,	77.83

The material was of a dark brown color, and evidently not the pure ash, for it contained 77.83 per cent. of worthless earthy matter. The ash in the above-described state does not pay carrying any considerable distance; it is worth much less than leached ashes.

Waste Hemlock Tan Bark Ashes.

[Sent on from Peabody, Mass.]

	Per cent.
Moisture at 100° C.,	4.87
Phosphoric acid,	0.13
Calcium oxide,	37.26
Magnesium oxide,	2.98
Potassium oxide,	2.10
Insoluble matter,	24.33

This ash, from a waste product of a tannery, has lost a large percentage of its original potash.

Hard Pine Wood Ashes.

[Sent on from South Lincoln, Mass.]

	Per cent
Moisture at 100° C.,	0.75
Total insoluble matter,	29.90
Insoluble mineral matter,	23.74
Calcium oxide,	24 95
Magnesium oxide,	8 39
Phosphoric acid,	2.24
Potash,	10.16

This material shows an exceptionally high per cent. of potash.

Canada Wood Ashes.

[I., II. Sent on from Concord, Mass. III., IV. Sent on from South Deerfield, Mass.]

	I.	II.	III.	IV.
Moisture at 100° C.,	17.00	18.15	4.90	2.48
Potassium oxide,	4.28	4.80	7.42	6.53
Calcium oxide,	31.31	30.69	42.10	42.98
Magnesium oxide,	2.36	3.71	3.55	3.66
Phosphoric acid,	3.34	3 26	2.00	1.44
Insoluble matter,	15.50	17.35	7.12	4.87

These samples represent the extremes of composition noticed in our section of the State. The use of Canada ashes has of late steadily increased, and the cost gradually declined to 24 to 25 cents per bushel of forty-five to fifty pounds. These are prices by the car-load at Amherst and in its vicinity.

Wood Ashes.

[I. Sent on from South Framingham, Mass. II. Sent on from West Tisbury, Mass. III., IV. Sent on from South Sudbury, Mass.]

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	5.10	17.63	17.43	11.76
Total phosphoric acid,	1.30	1.66	1.70	1.41
Magnesium oxide,	3.24	3.42	2.88	3.12
Calcium oxide,	39.07	34.54	29.87	32.81
Potassium oxide,	5.76	3.67	4.30	5.58
Insoluble matter (before calcination),	9.20	11.08	18.38	16.57
Insoluble matter (after calcination),	7.68	8.86	15.48	13.26

The difference in moisture in the above analyses explains somewhat the difference in potash.

Wood Ashes. (Two samples.)

[Sent on from South Deerfield Farmers' Club.]

	Pounds per Hundred.	
	I.	II.
Moisture at 100° C.,	16.75	11.79
Phosphoric acid,	1.79	1.34
Calcium oxide,	32.28	34.62
Magnesium oxide,	3.48	4.02
Potassium oxide,	1.80	6.68
Insoluble matter,	16.55	9.50

The first article is evidently a partly leached wood ash. The two samples differ mainly in regard to their relative amount of potash. This difference expressed in money value amounts to from 26 to 27 cents per hundred weight of ashes, allowing 5.5 cents per pound of potassium oxide in case of wood ash.

Wood Ashes.

[I., II. Sent on from Somerset, Mass. III. Sent on from Byfield, Mass.]

	Per Cent.		
	I.	II.	III.
Moisture at 100° C.,	4.82	2.43	9.98
Phosphoric acid,	3.07	1.45	1.80
Calcium oxide,	34.42	45 09	33.51
Magnesium oxide,	4.09	2.64	3.54
Potassium oxide,	4.56	1.99	1.28
Insoluble matter (before calcination),	18.17	12.57	22.43
Insoluble matter (after calcination),	15.37	7.71	19.15

Nos. II. and III. are evidently leached wood ashes.

Ashes of Cotton Seed Hulls.

[I. Sent on for examination from South Deerfield, Mass. II. Sent on from North Amherst, Mass.]

	Pounds per Hundred.	
	I.	II.
Moisture at 100° C.,	10.95	6.38
Phosphoric acid (6 cents per pound),	6.90	10.69
Calcium oxide,	5.76	13.34
Magnesium oxide,	9 15	Not determined.
Potassium oxide (5½ cents per pound),	25.34	24.16
Insoluble matter,	10.45	10.72
Valuation per 2,000 pounds,	$36 15	$39 41

There is evidently a considerable variation in the composition of this article. Direct communication from a well-informed

Southern source accounts for this fact by stating that more or less seeds are not unfrequently mixed with hulls when burned. An article which represents a high money value, like the above material, ought to be bought only on analysis.

Cotton Seed Hull Ash.

[Sent on from Northampton, Mass.]

	Per Cent.			
	I.	II.	III.	IV.
Moisture at 100° C.,	7.43	7.77	7.30	8.23
Phosphoric acid (6 cents per pound),	5.21	9.68	9.59	11.19
Magnesium oxide,	10.11	14.48	14.81	16.71
Calcium oxide,	6.71	18.42	12.23	12.43
Potassium oxide (5½ cents per pound),	25.76	17.34	19.15	24.91
Insoluble matter (before calcination),	12.36	11.30	10.88	7.34
Insoluble matter (after calcination),	12.18	6.34	8.86	5.18
Valuation per ton of 2,000 pounds,	$36 78	$30 70	$32 58	$40 83

Cotton Seed Hull Ash.

[Sent on for examination from Northampton, Mass.]

	Per cent.
Moisture at 100° C.,	2.30
Calcium oxide,	11.63
Magnesium oxide,	15.24
Phosphoric acid (6 cents per pound),	13,67
Potassium oxide (5½ cents per pound),	30.82
Insoluble matter,	21.65
Valuation per 2,000 pounds,	$50 30

The percentage of potash found in the above sample is exceptionally high. The same may be said of the phosphoric acid.

Muriate of Potash.

[I. Sent on from Northampton, Mass. II. Sent on from Williamsburg, Mass. III. Sent on from South Deerfield, Mass.]

	POUNDS PER HUNDRED.		
	I.	II.	III.
Moisture at 100° C.,	1.02	2.00	4.05
Potassium oxide,	50.09	54.45	45.94
Sodium oxide,	9.94	Not de-	termined.
Magnesium oxide,	0.63	Not de-	termined.
Valuation per 2,000 lbs.,	$42 58	$46 28	$39 05

The large amount of moisture in the last sample explains somewhat the lower percentage of potassium oxide. The principal admixture of salines in this brand of potash compounds consists of common salt, usually from 14 to 18 per cent.

Muriate of Potash.

[I. Sent on from Fall River, Mass. II. Sent on from Amherst, Mass.]

	PER CENT.	
	I.	II.
Moisture at 100° C.,	0.49	0.27
Potassium oxide (4¼ cents per pound),	50.79	51.82
Sodium oxide,	10.08	9.85
Valuation per 2,000 lbs.,	$43 27	$44 09

Sulphate of Potash.

[Sent on for examination, Amherst, Mass.]

	Per cent.
Moisture at 100° C.,	0.80
Potassium oxide (5½ cents per pound),	47.86
Sodium oxide,	1.68
Sulphuric acid (5½ cents per pound),	45.06
Chlorine,	0.66
Insoluble matter,	0.60
Valuation per ton of 2,000 lbs.,	$52 65

Double Manure Salt.

[Sent on from New York.]
[I. Crystallized double manure salt. II. Commercial double manure salt.]

	Per Cent.	
	I.	II.
Moisture at 100° C.,	11.58	6.58
Magnesium oxide,	10.81	11.50
Calcium oxide,	–	2.93
Sodium oxide,	3.16	4.16
Potassium oxide (5½ cents per pound),	22.40	23.28
Sulphuric acid,	39.89	43.43
Chlorine,	0.14	1.08
Insoluble matter,	0.26	1.80
Valuation per 2,000 lbs.,	$24 64	$25 61

The first-named article consisted of large, clear, colorless and well-developed crystals, which, in consequence of a loss of water, turned gradually whitish on exposure to the air. The second one consisted of a yellowish white powder, and represents the article for our markets. Both salines consist essentially of sulphate of potash and sulphate of magnesia, and are remarkably free from chloride (common salt, etc.).

Fish Waste.

[I. Sent on from Boston. II. Sent on from Gloucester. III. Sent on from Marshfield.]

	Per Cent.		
	I.	II.	III.
Moisture at 100° C.,	71.11	8.62	40.35
Organic and volatile matter,	–	50.16	73.01
Ash,	–	49.84	26.99
Total phosphoric acid,	0.60	6.99	2.94
Soluble phosphoric acid,	–	0.67	–
Reverted phosphoric acid,	–	2.90	1.06
Insoluble phosphoric acid,	–	3.42	1.88
Nitrogen,	2 21	4.97	5.07
Insoluble matter,	–	0.74	0.17
Valuation per 2,000 lbs.,	$4 58	$23 75	$12 50

The difference in the moisture and in the mechanical condition of the above-stated articles controls largely their market value. Samples I. and III. consisted of large pieces of fish meat with fatty matter; the valuation is based in these cases on that of coarse fish scrap. Sample II. corresponds well with a fair specimen of fish guano.

Dried Fish.

[Sent on from North Hatfield, Mass.]

	Per Cent.		
	I.	II.	III.
Moisture at 100° C.,	8.07	9.10	9.43
Total phosphoric acid,	5.87	8.78	7.37
Soluble phosphoric acid (8 cents per pound),	0.58	0.48	0.51
Reverted phosphoric acid (7½ cents per pound),	2 34	4.08	3.07
Insoluble phosphoric acid (3 cents per pound),	2.95	4.22	3.79
Nitrogen (17 cents per pound),	7.80	8.20	8.44
Insoluble matter,	3.86	3.00	1.30
Valuation per ton of 2,000 lbs.,	$32 71	$37 29	$36 39

Peruvian Guano.

[Sent on for examination, Taunton, Mass.]

	Per cent.
Moisture at 100° C.,	10.13
Total phosphoric acid,	14.31
Soluble phosphoric acid,	1.66
Reverted phosphoric acid,	4.91
Insoluble phosphoric acid,	7.74
Potassium oxide,	2.16
Nitrogen (total),	7.20
Actual ammonia (equal to 5.43 per cent. nitrogen),	6.60
Organic nitrogen,	1.77
Insoluble matter,	4.66
Valuation per 2,000 lbs.,	$42 62

Apparently an artificial product.

Fish and Potash.

[Sent on for examination from Medfield, Mass.]

	Per cent.
Moisture at 100° C.,	23.58
Total phosphoric acid,	6.26
Soluble phosphoric acid (8 cents per pound),	3.58
Reverted phosphoric acid (7½ cents per pound),	1.33
Insoluble phosphoric acid (3 cents per pound),	1.35
Potassium oxide (4¼ cents per pound),	3.24
Nitrogen (17 cents per pound),	3.07
Insoluble matter,	1.90
Valuation per 2,000 lbs.,	$21 73

High Grade Superphosphate.

[Sent on from Boston, Mass.]

	Per cent.
Moisture at 100° C.,	5.03
Total phosphoric acid,	25.36
Reverted phosphoric acid,	15.23
Soluble phosphoric acid,	0.25
Insoluble phosphoric acid,	9.88
Sulphuric acid,	0.22
Calcium oxide,	0.70
Oxides of alumina and iron,	24.95
Magnesium oxide,	0.10
Insoluble matter,	18.91
Valuation per ton of 2,000 lbs.,	$29 18

German High Grade Superphosphate.

[I. Sent on from New York City, N. Y., by a Boston manufacturer of fertilizers.
II. Sent on from Boston, Mass.]

	Pounds per Hundred.	
	I.	II.
Moisture at 100° C.,	15.24	7.50
Total phosphoric acid,	45.54	43.24
Soluble phosphoric acid,	41.56	36.62
Reverted phosphoric acid,	3.58	5.67
Insoluble phosphoric acid,	0.40	0.95
Insoluble matter,	5.20	2.50
Valuation per 2,000 lbs.,	$78 47	$67 67

The material serves for the manufacture of high grades of "formula fertilizers." The amount of sulphuric acid present in either sample did not exceed 3.5 per cent. This fact shows that the product is obtained by a different process than our ordinary superphosphates; it is most likely the isolated soluble portion of the latter evaporated after its separation from the insoluble sulphate of lime, etc.

Flamingo Guano.

[Sent on from Worcester, Mass.]

	Per cent.
Moisture at 100° C.,	17.20
Total phosphoric acid,	16.16
Soluble phosphoric acid,	0.48
Reverted phosphoric acid,	5.22
Insoluble phosphoric acid,	10.46
Potassium oxide,	0.31
Nitrogen,	0.80
Insoluble matter,	2.95
Valuation per 2,000 lbs.,	$17 86

Dissolved Boneblack.

[Sent on from South Deerfield, Mass.]

	Per cent.
Moisture at 100 C.,	20.43
Total phosphoric acid,	16.14
Soluble phosphoric acid,	15.81
Reverted phosphoric acid,	0.18
Insoluble phosphoric acid,	0.15
Insoluble matter,	0.94
Valuation per 2,000 lbs.,	$25 64

The article is a fair representative of its kind; its moisture is rather more than usual.

Compound Fertilizers.

[I. and II. Sent on from Methuen, Mass. III. Sent on from Groton, Mass. IV. Sent on from Lowell, Mass.]

	PER CENT.			
	I.	II.	III.	IV.
Moisture at 100° C.,	9.03	17.24	23.00	10.40
Organic and volatile matter,	34.28	51.04	55.30	48.76
Ash,	65.72	48.96	44.70	51.24
Total phosphoric acid,	7.96	6.06	12.67	17.88
Soluble phosphoric acid,	0.16	3.97	1.41	4.54
Reverted phosphoric acid,	2.52	0.93	7.36	9.78
Insoluble phosphoric acid,	5.28	1.16	3.90	3.56
Potassium oxide,	5.92	1.02	1.03	0.10
Nitrogen,	1.30	1.92	1.73	3.03
Insoluble and silicious matter,	4.16	22.36	3 70	1.88
Valuation per ton of 2,000 lbs,	$16 66	$15 85	$22 42	$34 37

Compound Fertilizers.

[Sent on for examination from South Hadley Falls, Mass.]

	PER CENT.		
	I.	II.	III.
Moisture at 100° C.,	5.24	8.08	12.45
Total phosphoric acid,	15.07	10.44	6.62
Soluble phosphoric acid,	0.29	2.88	0.58
Reverted phosphoric acid,	3.57	4.00	2.53
Insoluble phosphoric acid,	11.21	3.56	3.51
Nitrogen,	5.77	4.03	4.17
Potassium oxide,	–	7.64	6.45
Insoluble matter,	1.23	1.06	5.00
Valuation per ton of 2,000 lbs.,	$32 17	$32 94	$26 50

Compound Fertilizers — Concluded.

[IV. Sent on from Amesbury, Mass. V. Sent on from Newburyport, Mass.]

	PER CENT.	
	IV.	V.
Moisture at 100° C.,	9.21	6.43
Total phosphoric acid,	21.10	20.89
Soluble phosphoric acid,	0.77	0.70
Reverted phosphoric acid,	7.82	7.07
Insoluble phosphoric acid,	12.51	13.12
Nitrogen,	3.03	2.75
Potassium oxide,	–	–
Insoluble matter,	1.02	2.27
Valuation per 2,000 lbs.,	$32 14	$30 73

Steamed Bone.

[I. Sent on from Monson (fine ground). II. Sent on from Worcester (contained many coarse pieces).]

	PER CENT.	
	I.	II.
Moisture at 100° C.,	5.70	5.06
Organic and volatile matter,	40.68	33.68
Ash,	59.32	66.32
Total phosphoric acid,	21.99	26.17
Reverted phosphoric acid,	3.23	6.56
Insoluble phosphoric acid,	18.76	19.61
Nitrogen,	3.53	3.17
Insoluble matter,	2.10	2.61
Valuation per 2,000 lbs.,	$34 20	$33 77

The difference in the mechanical condition of the steamed bones causes the variation in the valuation of the phosphoric acid and of the nitrogen. The first sample was of a good average fineness; the second consisted largely of coarse yet porous pieces; the phosphoric acid in the latter is valued at four cents per pound, and the nitrogen thirteen cents, whilst five and fifteen respectively are allowed in case of the former.

Ground Bone.

[I. Fine-ground bone sent on from Concord, Mass. II. Fine-ground bone compost sent on from Concord, Mass.]

	Per Cent.	
	I.	II.
Moisture at 100° C.,	4.78	21.73
Organic and volatile matter,	25.48	38.76
Ash,	74.52	61.24
Total phosphoric acid,	29.83	9.81
Reverted phosphoric acid,	9 22	0.88
Insoluble phosphoric acid,	20.61	8.93
Potassium oxide,	-	2.95
Nitrogen,	2.03	0.50
Insoluble matter,	0.30	8.00
Valuation per ton of 2,000 lbs.,	$34 39	$14 26

The above samples of rendered, ground bones, and of a bone compost prepared from the former by mixing with wood ashes, were sent on to ascertain the exact changes which the material had suffered after a few months' keeping. The analyses show less *soluble* phosphoric acid, and also less nitrogen for the same amount of phosphoric acid in the bone compost, when compared with the original bones.

The operation of composting bones with wood ashes proved in the present case a decided loss, for more than one-fourth of the original nitrogen had been lost in the form of ammonia. A sample of the material, sent on for examination, gave evidence of the gradual escape of ammonia when kept for a few days in a well-closed bottle.

To derive benefit from composting bones with wood ashes requires a careful protection of the mixture against the escape of ammonia, which is invariably formed in the course of time. The mixture ought to be covered at once with a layer of good loam, from six to eight inches in thickness. In addition to this, it is well to scatter some gypsum (plaster) or ground kieserite (crude sulphate of magnesia) over the entire compost heap. The practice of mixing the ground bone with from three to four times its bulk of good soil, moistening the mixture thoroughly with liquid manure, and subsequently covering up the entire mass in a similar way with earth and gypsum or kieserite, also deserves recommendation.

Bone Soup.

[Sent on from Lynn, Mass.]

	Per cent.
Moisture at 100° C.,	82.92
Dry matter,	17.08
Nitrogen,	1.26
Ash constituents,	7.07

The liquid was obtained in rendering bones. Its ash constituents consist mainly of common salt with a small percentage of bone phosphate, and its agricultural value depends mainly on the nitrogen present. Allowing fifteen cents per pound of that element, one ton of the soup represents a value of $3.78. It ought to be economized.

Dried Blood.

[Sent on for examination.]

	Per cent.
Moisture at 100° C.,	11.99
Nitrogen (17 cents per pound),	13.55
Valuation per 2,000 lbs.,	$46 07

Ammonium Sulphate.

[Sent on from Amherst, Mass.]

	Per cent.
Moisture at 100° C.,	0 13
Nitrogen 20.88 per cent.; equal to ammonia,	25.35
Sulphuric acid,	59.74

MISCELLANEOUS ANALYSES.

Examinations for Metallic Poisons.

Four samples of material have been sent for investigation. Three examinations were made at the request of the Cattle Commission of the State. The material sent consisted in these cases of the stomach and some of the adjoining organs with their contents, besides the liver, bile and bladder of three cows. Two of these specimens came from Ashfield and one from Enfield, Mass. In the first case — from Ashfield — there was found a considerable quantity of copper, apparently due to presence of fine scraps of brass among the contents of the stomach ; in the others no metallic poison could be detected. The fourth case came from Amherst, Mass. The material for examination consisted of the stomachs, with contents, of chickens. A considerable quantity of arsenic acid was proved to be present.

Analyses of Maple Sap for Mineral Constituents.

[Sent on from Goshen, Mass. I. Sample from an old tree, sp. gr., 1.015, at 23° C. II. Sample from a young tree, sp. gr., 1.010, at 23° C.]

	PARTS PER THOUSAND.	
	I.	II.
Calcium oxide,	0.114	0.108
Magnesium oxide,	0.067	0.075
Silicic acid,	0.029	0.026
Chlorides of alkalies,	0.180	0.200

The examination was made to ascertain the relative amount of lime present in both saps. The difference is but slight, as may be seen from the above analyses.

Analyses of Well Water, sent on for Examination.

[Parts per Million.]

	Actual Ammonia.	Albuminoid Ammonia.	Chlorine.	Solids at 100° C.	Solids at red heat.	Hardness (Clark's degree).
I.,	.32	.36	38.00	280.00	95.00	–
II.,	.09	.14	18.50	140.00	80.00	4.03
III.,	.14	.25	9.00	Not deter-	mined.	–
IV.,	.04	.17	56.00	Not deter-	mined.	–
V.,	.12	.16	12.00	.098	.038	–
VI.,	.05	.12	16.00	.126	.036	4.71
VII.,	.03	.08	3.00	.046	.034	2.47
VIII.,	.04	.06	5.00	.062	.044	4.03
IX.,	.12	.09	4.00	.134	.100	7.43
X.,	.04	.06	3.00	.136	.100	6.71
XI.,	.02	.08	5.00	.064	.039	–
XII.,	.014	.00	.06	–	–	2.90
XIII.,	.01	.08	76.00	.280	.082	5.65
XIV.,	.004	.064	13.00	.092	.062	2.73
XV.,	.006	.056	14.50	.100	.04	2.28
XVI.,	.04	.07	4.00	.082	.052	4.16
XVII.,	.02	.093	22.00	.164	.06	4.71
XVIII.,	–	.102	7.00	.104	.052	5.71
XIX.,	.04	.07	4.00	.082	.052	4.16
XX.,	.02	.093	22.00	.164	.06	4.71
XXI.,	–	.102	7.00	.104	.052	5.71

The above-stated results of analyses of drinking water are obtained from samples sent on for that purpose from various parts of the State. In most instances these requests are accompanied by a specified instruction regarding the object of the party interested, — a circumstance which renders the task of the chemist, comparatively speaking, an easy one.

A satisfactory supply of good drinking water on a farm depends, in a controlling degree, on a judicious selection of the location of the well designed for the use of the family and for the live stock, and on the personal attention bestowed, from time to time, on the condition of the latter and its surroundings. Good wells are liable to change for the worse at any time, on account of circumstances too numerous to state in this connection. To ascertain from time to time the exact condition of the well which supplies the wants of the family and of the live stock, is a task which no farmer can for any length of time discard, without incurring a serious risk in health and prosperity. The subject receives quite frequently but little attention, on account of the fact that the harmful qualities which an apparently good water may contain are disguised beyond recognition by the unaided senses. Certain delicate chemical tests, aided at times by microscopical observations, are, in the majority of cases, the only reliable means, in our present state of scientific inquiry, by which desirable information regarding the true character of a drinking water can be obtained.

These tests, it must be acknowledged, although of the greatest importance from a general standpoint, have their limitations. They readily indicate the presence of organic matters, but give no unfailing decision regarding their origin, — whether animal or vegetable, — leaving thus, quite frequently, the degree of their harmfulness quite undecided. However, the chemical analysis may be depended upon for all practical purposes, as revealing the presence of objectionable qualities in the water.

The harmful substances found in drinking water are of two classes, — mineral and organic. Few natural waters are entirely free from mineral matters; nearly all contain small quantities of lime, soda, magnesia and iron, — substances which may be considered harmless in that case. Larger quantities of these elements, however, render the water objectionable for drinking, and also more or less unfit for various applications, as washing and cooking, feeding of steam apparatus, etc.

Foremost among the dangerous mineral substances which have been found in drinking water is lead. Its presence is usually due to the use of lead-pipes for conducting the water from the well to the pump and elsewhere. Lead is a treacherous and dangerous poison. Not a trace should be tolerated in drinking water. The use of lead pipes for conducting the latter for any of the above-named purposes should be decidedly discouraged.

The most frequent source of danger comes, evidently, from the presence of organic matter, indicating contamination by decaying animal and vegetable substances. Wells are not infrequently found polluted by the gases and liquids emanating from sinks, privies, cesspools or barnyards, when apparent conditions would seem to render it impossible.

Attention has already been called to this important matter in a previous report; for one of the first requirements of success on a farm consists in an ample supply of good water. Cities and towns usually have their organizations for the supply of water, and they exact certain guarantees regarding the quality furnished for their use. The farmer, living as a rule more isolated, is in this respect largely left to his own counsel. Much has been written on this subject; yet, as the necessity for constant warning still remains, a restatement of certain facts cannot fail to assist in keeping the subject here under consideration prominently before all parties concerned. The above-recorded analyses have been made according to Wancklyn's process, familiar to chemists, and are directed toward the indication of the presence of chlorine, free and albuminoid ammonia, and the poisonous metals. (For a more detailed description of this method see Water Analysis, by J. A. Wancklyn and E. T. Chapman.)

The hardness was determined by Frankland's method. (See Frankland's Water Analyses, page 29.)

The presence of chlorine indicates contamination from sinks, privies or sewers, since it occurs abundantly in urinary secretions; but it may be derived from other and less harmful sources, as saline waters, which the test fails to indicate. One conclusion is, however, safe, — a water which contains no chlorine is uncontaminated by sewerage. "Free" and "albuminoid" ammonia are forms in which organic matter is recognized. Ammonia existing as such in water is termed "free." This being expelled by distillation, the nitrogen-containing organic matter remaining is reduced to ammonia by chemical agencies, and this secondary product is called "albuminoid ammonia."

The per cent. of total solids is obtained by evaporating a known quantity of the sample to dryness and weighing the residue.

Hardness, a rather arbitrary term, signifies that quality of water which prevents the ready formation of lather with soap. It is usually due to the presence of salts of lime or magnesia, which decompose the soap, forming new insoluble compounds. As long as these reactions occur no lather will be formed, consequently the quantity of a standard soap consumed before a permanent lather is obtained indicates the amount of earthy salts contained in the sample, or its relative degree of hardness. Frankland's scale has been changed to Clark's, the latter being a more popular one. Ten degrees of Frankland's scale are equivalent to seven of Clark's.

Mr. Wancklyn's interpretation of the results of his mode of investigation are as follows: —

1. Chlorine alone does not necessarily indicate the presence of filthy water.

2. Free and albuminoid ammonia in water without chlorine indicates a vegetable source of contamination.

3. More than five grains per gallon of chlorine, accompanied by more than 0.08 parts per million of free ammonia and more than one-tenth part per million of albuminoid ammonia, is a clear indication that the water is contaminated with sewage, decaying animal matter, urine, etc., and should be condemned.

4. Eight hundredths part per million of free ammonia and one-tenth part per million of albuminoid ammonia render a water very suspicious, even without much chlorine.

5. Albuminoid ammonia over 0.15 parts per million ought to absolutely condemn the water which contains it.

6. The total solids found in the water should not exceed forty grains per gallon.

An examination of the above results of analyses shows that Nos. 4, 6 and 13 are of a suspicious character, and that Nos. 1, 2, 3, 5, 9 and 12 ought to be condemned.

Parties sending on water for an analysis ought to be very careful to use clean vessels, clean stoppers, etc. The sample should be sent on without delay after collecting. One gallon is desirable for the analysis.

METEOROLOGY.

The meteorological observations during the year 1886 have been carried out on the same general plan as was followed in 1885. The system is essentially the same as that recommended to voluntary observers of the U. S. Signal Service. (See Third Annual Report.) The relative humidity has, however, been obtained only during the growing season ; it was found impracticable with our present facilities to run the "wet bulb" thermometer during the winter months. Our monthly records of observations have been forwarded regularly at the earliest possible date to the chief Signal Office during the entire year.

The importance of weather observations to the Station itself, in connection with its field experiments, cannot be overestimated. The summaries, as they appear from time to time in our bulletins and annual reports, are not without some interest to the farmers throughout the State. For the benefit of the farmers in our vicinity a more complete system of flag signals to indicate the expected changes in the weather will be introduced during the coming season.

The more conspicuous local meteorological phenomena of the past year (1886) consist in the early opening of the spring, the even distribution of the rainfall throughout the growing season, the absence of severe early or late frosts, and the abundant rainfall during the autumn months. Only once during the summer, the first half of July, did the drought become of sufficient severity to injure vegetation, and then but slightly. The first important snowfall of the year occurred January 9 (seven inches). Good sleighing was noticeable only at intervals throughout the remainder of the winter. The effect of two "ice storms," so injurious to orchards and shade trees throughout the central part of the State, was not felt here. The heavy rainfall of February 10 to February 14 did no material damage. The total snowfall for the months of January, February and March was 23.0 inches ; on April 3, 0.5 inches of snow fell ; from the 5th to the 7th occurred a rain and snow storm of considerable severity. The latest damaging frost was on April 30, and the last of the season occurred May 18, doing no material harm. The season was, at the beginning of May, judging from the state of the vegetation, at least two weeks in advance of the general average year.

The following table gives the temperatures and rainfall, arranged in fortnightly periods, for the spring and fall months : —

	April, Last 15 Days.	May, First 15 Days.	May, Last 16 Days.	June. First 15 Days.	Aug., Last 15 Days.	Sept., First 15 Days.	Sept., Last 15 Days.	Oct., First 15 Days.
Precipitation.								
Average for 48 years, .	1.73 in.	2 06 in.	1.86 in.	1.81 in.	2.02 in.	1.46 in.	1.84 in.	1.89 in.
For 1885, . . .	1.78 in.	1.01 in.	2.07 in.	1.61 in.	3.45 in.	0.69 in.	1.01 in.	1.68 in.
For 1886, . . .	0.10 in.	2.73 in.	0.37 in.	0.88 in.	1.63 in.	0.51 in.	4.97 in.	0.10 in.
Temperature.								
Average for 48 years, .	48.6°	57.0°	60.4°	64.9°	67.5°	64.3°	58.0°	52.4°
For 1885, . . .	51.6°	46.9°	61.1°	60.7°	63.2°	59.9°	52.9°	49 1°
For 1886, . . .	57.7°	55.7°	58.5°	61.8°	66.0°	62.9°	56.1°	52.2°

The first frost of the fall occurred September 2 ; but little damage was done. Other light frosts followed September 14, 21 and 22. The first killing frost came October 3 ; on the 17th the ground was frozen to the depth of one inch, and the minimum thermometer registered 17° F. The first snow of the winter of 1886 and 1887 came November 13, amounting to one inch ; during December there was a fall of 16 inches, making a total of 40.5 inches for the entire year.

The prevailing direction of the wind, as taken from the monthly summaries, gives 29.2 per cent. from the northwest, 33.3 per cent. from the south, 20.9 per cent. from the north, 8.3 per cent. from the southwest, and 8.3 per cent. from the west.

Rain or snow fell in measurable quantities on 122 days. The greatest number of such days in any one month was sixteen, in December, and the fewest was six, in April.

The "clear" days, *i. e.*, those on which the sky was less than four-tenths overcast at each observation, numbered 104, of which July had the greatest, thirteen ; and April the fewest, four.

The "cloudy days," or those on which the sky was more than seven-tenths obscured at each observation, were eighty-seven in number, of which January, March and December had the greatest, eleven each; and August fewest, two. The balance of the year, 174 days, was "fair," with the sky from four to seven-tenths obscured at each observation.

The highest temperature recorded throughout the year was 95.0°, occurring July 6; and the lowest — 22.0°, January 13 and 14, giving as the absolute range of temperature for the year 117.0°.

Miscellaneous Phenomena. — Dates.

	Frost.	Snow.	Rain.	Thunder-storms.	Solar Halos.	Lunar Halos.
January, . . .	2, 14, 15, 16.	9, 18, 19, 24, 30.	4, 5, 18, 19, 21, 27, 28, 29, 30.	–	11, 13, 31.	20.
February, . . .	1, 15, 17, 18, 19.	21, 22, 25, 26.	11, 12, 13, 15, 19, 25, 26.	–	4, 6.	18.
March, . . .	6, 7, 17, 18.	8, 9, 12, 19, 21, 22.	13, 21, 27, 29.	–	–	–
April, . . .	2, 9, 30.	3.	5, 6, 7, 13, 19, 24, 27.	–	–	–
May, . . .	1, 18.	–	4, 5, 7, 8, 10, 11, 13, 15, 16, 20, 25.	20.	19.	–
June, . . .	–	–	2, 3, 13, 14, 15, 16, 17, 23, 24, 25, 26.	25, 26.	1.	20.
July, . . .	–	–	10, 14, 15, 16, 17, 18, 21, 26, 27, 29.	18, 27, 29.	–	–
August, . .	–	–	1, 2, 5, 7, 14, 16, 30, 31.	30.	–	–
September, . .	2, 14, 21, 22.	–	12, 13, 15, 16, 17, 19, 22, 23, 25, 26, 27, 28, 29.	17, 28.	–	–
October, . .	2, 3, 17, 22, 24.	–	14, 15, 17, 18, 26, 27, 28, 29, 30, 31.	–	–	–
November, . .	5, 8, 9, 16, 26, 27, 28, 29.	13, 25.	6, 7, 10, 12, 13, 17, 18, 22, 23, 25, 30.	–	4, 16.	–
December, . .	10, 21, 23.	5, 7, 13, 15, 16, 17, 18, 23, 24, 25, 26, 27, 29, 30, 31.	12, 13, 17, 18, 31.	–	4.	4, 10.

Summary of Meteorological Observations, 1886.

	Temperature. Degrees Fahrenheit.											Relative Humidity. Per ct.				Precipitation. Inches.	
	7 A. M.	2 P. M.	9 P. M.	Mean.	Maximum.	Minimum.	Range.	Absolute Maximum.	Date.	Absolute Minimum.	Date.	7 A. M.	2 P. M.	9 P. M.	Mean.	Depth of Water.	Date of Greatest Fall.
January,	17.7	26.0	21.9	21.9	31.2	16.5	14.7	56.0	5th	—22	13th, 14th	-	-	-	-	5.39	27th to 30th
February,	17.8	27.0	23.8	23.1	30.9	13.8	17.1	52.0	15th	—11	5th	-	-	-	-	3.94	11th to 13th
March,	28.8	38.5	33.3	33.5	40.4	23.9	16.5	61.0	31st	—1	1st	-	-	-	-	3.31	19th
April,	43.5	56.5	50.9	50.4	61.3	35.6	26.0	83.0	20th	20.0	11th	89.0	74.8	80.2	81.4	1.73	5th to 7th
May,	50.3	66.0	56.3	57.3	70.6	45.3	25.3	82.0	23d	29.0	1st	93.9	72.4	87.5	84.6	3.10	7th to 8th
June,	58.5	70.4	61.9	63.2	72.9	48.9	24.0	82.0	21st	40.0	1st	94.0	71.5	84.2	83.2	2.33	23d to 25th
July,	63.3	78.2	70.0	68.8	80.8	55.2	25.6	95.0	6th	40.1	12th	90.7	59.6	81.7	77.4	3.82	14th to 17th
August,	60.4	77.1	63.8	66.3	79.0	53.4	25.6	90.0	27th	38.0	23d	91.2	59.7	81.2	77.4	2.60	30th to 31st
September,	53.6	69.3	57.5	59.5	70.4	46.7	23.7	83.8	9th	31.6	21st	93.6	58.7	87.3	70.4	5.48	27th to 29th
October,	41.9	58.1	47.8	48.9	59.0	37.4	11.6	77.9	9th	17.0	17th	90.4	62.6	79.4	77.3	2.97	26th to 30th
November,	34.4	44.5	37.1	38.3	47.6	28.5	19.1	65.5	2d	15.9	28th	-	-	-	-	5.26	17th to 18th
December,	19.3	27.1	22.8	23.0	30.3	13.7	16.6	49.0	11th	0.8	30th	-	-	-	-	3.61	30th to 31st
Sums and means,	40.8	53.2	45.6	46.2	56.2	31.9	20.5	73.1	-	16.5	-	*91.8	*65.6	*83.1	*78.8	43.51	-

* Means of 7 months.

RECORD

Of the Average Temperature taken from Weather Records at Amherst, Mass., for three consecutive months, during the summer and winter, beginning with the year 1836.

December, January, February.		June, July, August.	
1836–37,	25.396° F.	1837,	69.130° F.
1837–38,	26.386°	1838,	69.550°
1838–39,	25.950°	1839,	70.180°
1839–40,	20.626°	1840,	68.770°
1840–41,	23.146°	1841,	69.230°
1841–42,	28.516°	1842,	68.210°
1842–43,	23.460°	1843,	67.950°
1843–44,	21.320°	1844,	67.260°
1844–45,	25.550°	1845,	70.120°
1845–46,	22.140°	1846,	68.406°
1846–47,	25.176°	1847,	68.806°
1847–48,	28.966°	1848,	69.210°
1848–49,	23.026°	1849,	69.210°
1849–50,	27.570°	1850,	68.820°
1850–51,	25.040°	1851,	66.640°
1851–52,	21.620°	1852,	66.830°
1852–53,	27.940°	1853,	67.846°
1853–54,	23.670°	1854,	69.856°
1854–55,	23.126°	1855,	67.146°
1855–56,	20.820°	1856,	69.225°
1856–57,	22.720°	1857,	67.240°
1857–58,	26.956°	1858,	67.930°
1858–59,	24.746°	1859,	65.650°
1859–60,	24.790°	1860,	66.540°
1860–61,	24.510°	1861,	66.870°
1861–62,	24.470°	1862,	66.490°
1862–63,	27.640°	1863,	66.656°
1863–64,	26.060°	1864,	69.336°
1864–65,	21.310°	1865,	68.946°
1865–66,	25.676°	1866,	67.400°
1866–67,	25.276°	1867,	67.920°
1867–68,	20.350°	1868,	69.700°

Record of Temperature, etc. — Concluded.

December, January, February.		June, July, August.	
1868-69, . . .	26.290° F.	1869, . . .	66.890° F.
1869-70, . . .	27.866°	1870, . . .	71.700°
1870-71, . . .	26.666°	1871, . . .	67.810°
1871-72, . . .	24.630°	1872, . . .	70.790°
1872-73, . . .	21.350°	1873, . . .	68.596°
1873-74, . . .	27.286°	1874, . . .	66.306°
1874-75, . . .	21.180°	1875, . . .	68.026°
1875-76, . . .	28.156°	1876, . . .	71.780°
1876-77, . . .	23.510°	1877, . . .	70.080°
1877-78, . . .	28.506°	1878, . . .	68.896°
1878-79, . . .	24.290°	1879, . . .	68.150°
1879-80, . . .	30.506°	1880, . . .	69.286°
1880-81, . . .	21.856°	1881, . . .	67.966°
1881-82, . . .	29.256°	1882, . . .	69.866°
1882-83, . . .	24.220°	1883, . . .	68.840°
1883-84, . . .	26.506°	1884, . . .	68.960°
1884-85, . . .	22.630°	1885, . . .	66.740°
1885-86, . . .	24.846°	1886, . . .	66.100°

SUMMARY

Of Average Temperature from 1836 to 1862 (25 years).

December, January, February.	June, July, August.
24.53° F.	68.26° F.

SUMMARY

Of Average Temperature from 1862 to 1887 (25 years).

December, January, February.	June, July, August.
25.21° F.	68.53° F.

A careful study of the above tables cannot fail to show that the average temperature of the three leading months during summer and winter seasons has not materially changed during the last fifty years,— a fact not generally conceded.

C. A. GOESSMANN,
Director.

JAMES P. LYNDE, *Treasurer, in Account with* MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION.

1886.	*Receipts.*		1886.	*Expenditures.*	
Jan. 1,	Cash in Bank,	$840 79		Salaries,	$3,149 75
2,	State Treasurer,	2,500 00		Laboratory Supplies,	975 76
12,	C. A. Goessmann, Director,	281 79		Printing and Postage,	591 86
April 3,	State Treasurer,	2,500 00		Office Expenses,	171 97
13,	C. A. Goessmann, Director,	61 55		Farmer and Farm Labor,	1,548 36
July 6,	State Treasurer,	2,500 00		Farm Supplies,	812 16
13,	C. A. Goessmann, Director,	59 01		Stock and Feed,	450 86
Oct. 1,	State Treasurer,	2,500 00		Miscellaneous Expenses,	388 93
				Fitting up Buildings,	2,617 35
				Expenses Board of Control,	135 15
				Cash in Bank Jan. 1, 1887,	400 99
		$11,243 14			$11,243 14

Examined, compared with the vouchers, and found correct.

ALVAN BARRUS,
Auditor of the Board of Control.

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